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By William J. Coulter

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By Carl Zapffe

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By Edwin C. Eckel

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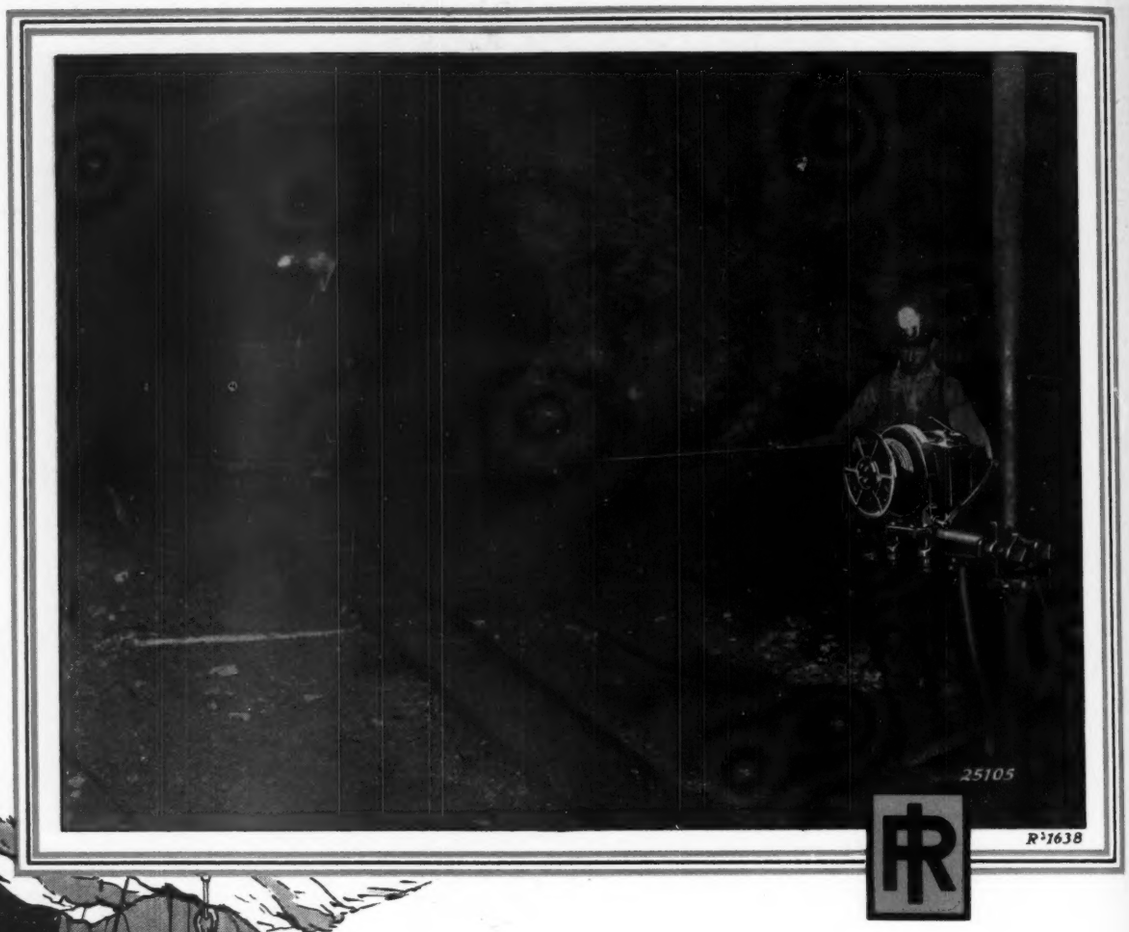

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New York, March 9, 1929

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A COLORADO READER writes as follows: "When the Clement and Govan paper on housing in cold climates began in the issue of Feb. 16, I was delighted. Yesterday I opened the issue of the 23d, hoping to find its continuation, but was disappointed. If it is not to be completed at once, might I have advance copies of the text? I am beginning to give serious consideration to my building problems, and that article bids fair to be helpful." Every mine manager who expects some time to have the housing problem to consider might well file these three articles.

Contents

Editorials 385

Anent Elementary Facts and Common-Sense Principles
Why Copper Prices Are Approaching 20 Cents
The Hydraulic Miner's Plea Deserves Attention
Barcelona Exhibition to Reveal the New Spain
Mexican Conditions Become More Disquieting
Miami Continues to Accomplish the "Seemingly Impossible"

Arthur Concentrator of Utah Copper..... 388
Illustration

Why Domestic Manganese Should Be Adequately Protected..... 389
By CARL ZAPFFE

Iron Ores of Northwestern France..... 392
By EDWIN C. ECKEL

Mining Molybdenum Ore at Climax, Colorado 394
By WILLIAM J. COULTER

Sulphur and Pyrites Production in United States Decreased During 1928..... 400

Useful Operating Ideas	401	Mining News	410	Mining Stocks	424
Comment and Criticism	403	Market and Financial News	415	Technical and Industrial Service Directory	37
Industrial Progress	406	Indicators of Industrial Activity	418	Searchlight Section	39-41
Digest of Current Literature	408	Market Report	419	What and Where to Buy	42, 44
Personal Notes	409	Metal Statistics	423	Advertising Index	46
Obituaries	409				

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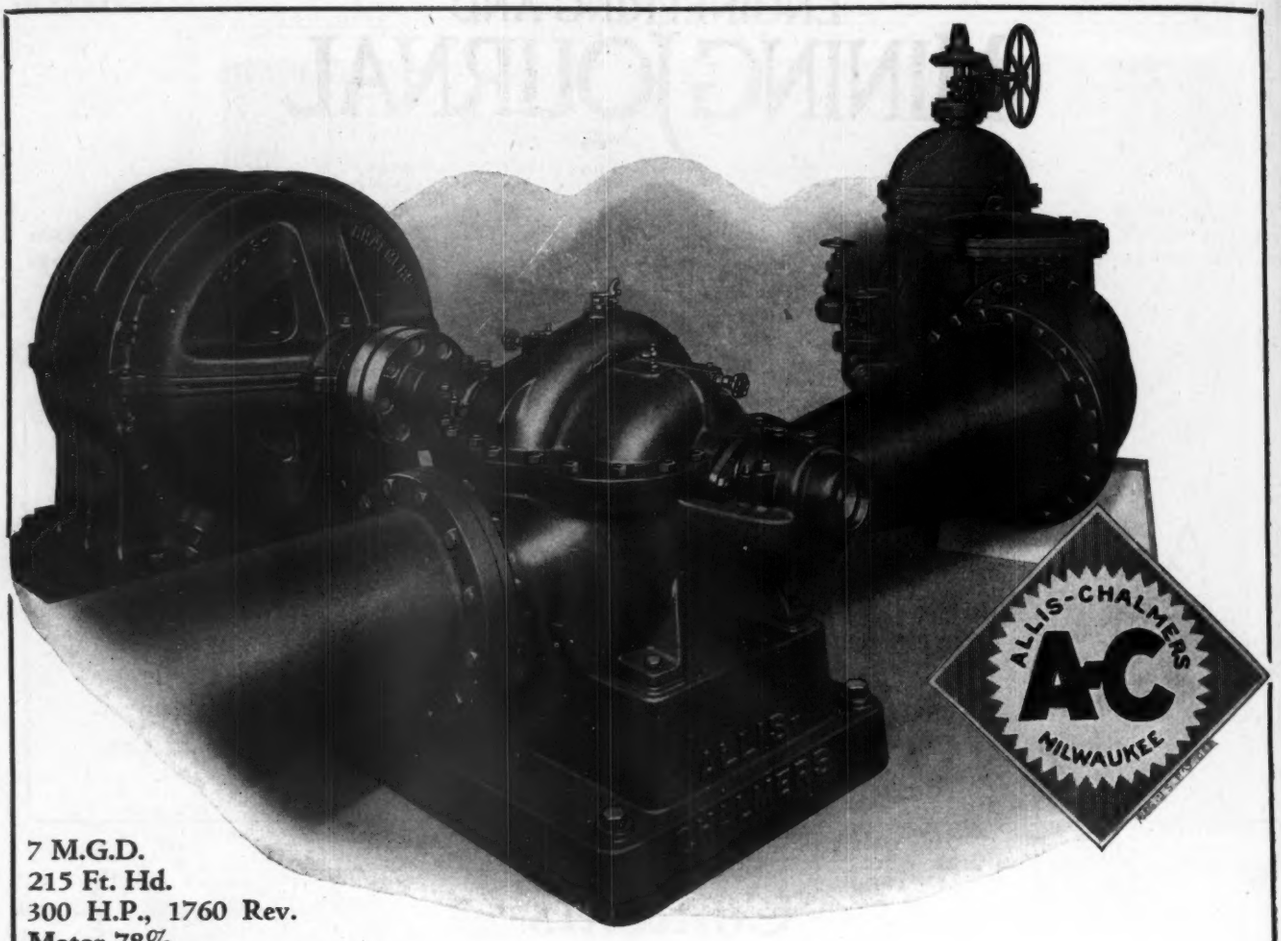

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Anent Elementary Facts and Common-Sense Principles

OCCASIONALLY a critic protests that something he has read is neither new nor novel. The objection has been met before, and will be met again, by an argument based on the thesis that the reiteration of an irrefutable axiom or the repetition of an important fact is likely to do more good than an incursion into the problematical. One is inclined nowadays to stress the importance of the undiscovered, meanwhile neglecting to take advantage of the obvious. Those who discriminate are wont to admit that more failures are traceable to a neglect of fundamentals than to insuperable obstacles. Greater exhilaration arises from an attempt to evolve a spectacular method of overcoming difficulties than to reason a way to success by the employment of basic facts and the recognition of common-sense principles.

One of the chief duties of the editorial staff of a technical paper is to answer inquiries from those who recollect or have been told that an editorial or an article on a subject in which interest has been awakened has at some indeterminate time appeared in print. Lucky indeed are those who are able to find the information needed; for the great majority lack the preliminary scent with which to justify a precise inquiry. Many of our correspondents candidly confess an ignorance of particular subjects, usually elemental, and for them we are inclined to bespeak the toleration of the other section of our readers, who might criticize adversely a repetition of what to them would appear as the obvious.

Mining engineering covers such an immense field that he who boasts of knowledge and proficiency in all its branches must be ignorant of his own shortcomings. To be frank, how many of us, if questioned on some special subject outside our own immediate experience, would be inclined to plead preoccupation with other matters, to give ourselves time and opportunity to consult an encyclopedia or a colleague? Part of an editor's time should be allocated to the segregation of the valueless from the essential, and to the emphasizing of the useful. Inadequate is the excuse, for example, that a particular explanation of a phenomenon was made ten years ago, or that a certain method of treatment was in practice and was described in 1898. In these times of stress and bustle no one man has the time to keep apace with all that is published and practiced; neither can the ordinary individual be trusted to separate the wheat from the chaff, as it were, and to store only what is valuable, for future use. If technical journalism is to fulfill its high purpose, it must step aside occasionally from an emphasis of the up to date, in order to impress on all and sundry the great importance of those elementary facts and common-sense principles that, one must confess, are often overlooked. The mere recapitulation of such facts and principles usually leads to a mental retrospection that is eminently stimulating. To forget the essential is as easy as to remember the recent and the spectacular, because our heads are always cluttered with rubbish that is stored away in the hope that it may ultimately prove of value.

The frequent reiteration of what is worth while is necessary, even though it disturb the equanimity of those whose memories do not need jogging on at least one particular subject. Others are less fortunate; and, as they constitute the majority, we will strive to serve them, taking no heed of the captious critic who gave us this text for a digression from our technical domain.

Why Copper Prices Are Approaching 20 Cents

COMMENT on the copper market's behavior during the last year has required a plethora of descriptive superlativeness. During the early part of the upward price movement, price changes were few and each small advance was accompanied by huge sales transactions. However, as consuming demand continued to increase and buying orders accumulated for forward deliveries the market began to assume a delicate "hair-trigger" balance, and a relatively small sales volume brought rapid advances in price. Since the first of January the price of copper has advanced 2¾ cents per pound, of which 2¼ cents was effected during February, 1¼ cents of the February advance coming in the last four days of the month, bringing the price within a cent of 20 cents a pound. This spectacular advance is directly attributable to the buying tactics involved, together with what appears to be a further increase in the rate of domestic consumption, and has not resulted from any preconceived conspiracy between producers, as is believed in some quarters, particularly among European consumers. A year and more ago buyers were committed to the "hand-to-mouth" buying policy. Consequently, when the real extent of the increase in consuming demand became apparent and a further upward price tendency seemed assured, they hastened to change their buying policy and sought commitments for deliveries further and further in advance. Late in February, for example, a large proportion of the tonnage sold to domestic consumers was for June delivery, or four months in advance. This change in buying practice has taken place, in large part, since the first of last September, resulting in the transaction of ten months' sales in six months' time. Recently, the hand of sellers has been forced further by the requests of large fabricators for small prompt lots in addition to

their forward purchases. This indication of a further increase in consumption is of primary significance, for it finds producers already taxing every facility to supply present requirements, which, if increased still more, would place the copper market in a chaotic condition indeed, and one in which almost any price might be attained.

The danger of such a sudden change in buying habits is evident, for consumers help to run up the price on themselves. It is to be hoped that forward buying will not cease if and when a slowing down of ultimate consuming demand becomes evident, so that further market instability will be encouraged. But something more fundamentally important than an increased demand for future shipment is responsible for copper's rise to a more remunerative price level. A very real increase in consumption has occurred, especially in the United States, to a degree greater than was anticipated by the producers. They have been especially careful to allocate a fair share of their production for their foreign customers, who have not bought so far ahead, and this has not left enough fully to satisfy the demands for the home trade.

But the old law of supply and demand is not dead. With a fair profit assured for the near future at least, not only will the American properties produce to their fullest capacity, but further development in Canada, Africa, and South America will be hastened and justified.

The Hydraulic Miner's Plea Deserves Attention

THE important points made by James D. Stewart, sponsor for the hydraulic miners of California, are that although modern concrete dams will provide proper storage for mining débris, the situation of the dams is such that all other débris resulting from natural erosion or otherwise will be likewise stored; that the miner is deserving of consideration by both state and federal legislatures, such consideration not involving paternalism where the miner obligates himself to pay for the service rendered by public funds; that the hydraulic miner should, as a matter of right, be permitted to work or be reimbursed.

The sympathies of the *E. & M. J.* are with the hydraulic miner, who was the victim of summary legislation without the complementary legislation that would have allowed him to exist. When that legislation was enacted later the disintegration of the industry was so far advanced that it has existed since only on an extremely restricted basis. Private enterprise, except in the instance of the Bullard's Bar dam, has failed to interest itself, principally because freedom from interference was not assured. Mr. Stewart believes that both state and federal governments should undertake the construction of the débris-restraining dams and to this extent encourage the rehabilitation of the industry. The fact that gold deposits on the watersheds of the Yuba and American rivers are of sufficient importance to promise substantial gold yields for several years should incite careful consideration of the ways and means by which such a development could be brought about. In the interest of diversified industry, legislators and business men should direct their attention to this problem of hydraulic mining and provide for an equitable solution fair to the hydraulic miner and to others directly and indirectly involved.

Barcelona Exhibition to Reveal the New Spain

ONCE AGAIN eyes will turn this spring to Spain, and for other reasons than the spectacular doings of Señor Primo de Rivera. Three years ago, in May, the Fourteenth International Geological Congress, meeting in Madrid, was the focus of attention. This May the International Exhibition of Arts, Industry, and Commerce, to be held at Barcelona, will be the attraction. The appeal this year is wider—to all the world, instead of to a comparatively small group that has specialized in geology.

Spain's industry is developing, and not as slowly as some may think. The prosperity it is enjoying has a reflection in the great enterprises that are being organized, in the undertaking of important hydraulic works, and in the improvement and extension of the systems of communication and transportation—something that the country greatly needs. The Spanish government has appropriated the neat sum of $300,000,000 for new industrial buildings, harbors, and naval bases and the development of water power. Today the country is more wide awake than it has been since the days of its colonial glory.

Spain's mineral wealth is great. To many engineers, prior to the Congress in Madrid, Rio Tinto and its ancient mines represented the country's mining industry. They should be better informed today, and by the time the Barcelona Exhibition is over, their knowledge should be even more extensive.

Rio Tinto's mines of copper-bearing pyrite are justly famous. Their production dates back almost to the dawn of history and has continued down to the present day. According to the statistics issued last year by the Consejo de Mineria, the Province of Huelva, in which they are situated, yielded approximately 3,500,000 tons of ore in 1926. But in that same year the country produced minerals, aside from quarry products, valued at 475,600,000 pesetas. Despite the fact that the peseta was then somewhat below its par of 19.3 cents, this is a lot of money.

In its variety the mineral output is likewise notable. It includes: Quicksilver, of which the provinces of Ciudad Real and Granada produced 30,000 tons of ore in 1926, this almost wholly from the former; sulphur, from Albacete, Almeria, Murcia, and Teruel, totaling 65,000 tons; zinc ore, from ten provinces, 200,000 tons in all and most of it above 25 per cent in grade; copper, 286,000 tons of ore averaging over 2 per cent, from Huelva and Leon; iron ore from seventeen provinces, the most important being Vizcaya, with one and a half million tons; lead ore, of which 216,000 tons came from twenty provinces, the tenor ranging from 37 to 76 per cent; salt, from ten provinces, the bulk of the 118,000 tons coming from Santander; and coal, including anthracite, bituminous, and lignite, over 6½ million tons in all, from no less than twenty provinces. Nor is the list complete. To it must be added refractory clay from Teruel, Pontevedra, and Tarragona; asphalt from Alava; barytes

from Tarragona; bismuth ore from Cordoba; kaolin from Valencia; fluorspar from Guipuzcoa; tin from Coruña; soapstone from Almeria; ochre from Alicante; tungsten from Badajoz and Coruña; and various other minerals.

Last but not least are the mineral waters, of which the province of Barcelona produced 32,000,000 tons in 1926. Prospective visitors need feel no alarm that they will be dependent wholly on Spanish wines during their stay.

These facts serve to show that Spain has truly a mineral industry of importance. To venture the opinion that this industry is susceptible of much greater development by the application of modern equipment is by no means hazardous. Machinery manufacturers who are arranging to send representatives to Barcelona will probably benefit therefrom in the future.

Mexican Conditions Become More Disquieting

NEWS from Mexico is not reassuring to those concerned with the development of the natural resources of the country. Reports of bandit outrages seem as frequent as ever; only two or three weeks ago two American mining engineers were killed, following which a train was wrecked and numerous minor outrages occurred. Now comes a revolution of no mean proportions in which a large section of the country is involved, with important ports and border cities in the hands of those anxious to overthrow the federal government.

So far as the United States is concerned, it is fortunate that the trouble is purely local to the country, and is not directed against foreigners. The attitude of Mexicans toward their friends to the north has measurably improved since Ambassador Morrow and Colonel Lindbergh entered upon the scene. The large mining companies report the friendly co-operation of the Mexican government, and the deaths of the two mining engineers above referred to were promptly avenged so far as the government was able. It is chiefly the outlying and smaller mining properties that have suffered from the lack of a strong centralized political control.

Observers of the Mexican situation fear that things may get worse before they get better. The religious difficulty is perhaps responsible in largest measure for the present unrest, and no change is yet apparent in the government's attitude in this matter. Economic conditions are bad also. President Gil has apparently made an earnest effort, but perhaps Mexico needs a Mussolini or a Rivera, to rule with an iron hand as did Diaz. Until a strong central government can be established, which will command respect throughout the country, and which will have the power to curb banditry even in the more remote districts, little encouragement will be offered to those who would otherwise avail themselves of the opportunity of developing some of the attractive mining prospects that have remained dormant for years. With higher copper prices, and lead seemingly on the up-grade also, much capital might be diverted to Mexico, were conditions satisfactory. It is to be hoped that the opportunity will not have to be indefinitely abandoned. The United States should be sympathetic and as helpful as it can. The outside world should remember that Mexico is a sovereign nation and that the solution of its difficulties must come from within.

Miami Continues to Accomplish the "Seemingly Impossible"

IN 1911 Miami Copper started production from its low-grade properties near Globe, Ariz. With Ray it shared the honor of being the pioneer porphyry enterprise in Arizona, although both Utah and Nevada Consolidated were established successes at the time. The main orebody at Miami, when exploitation started, consisted of about twenty million tons of 2 per cent copper ore. Once capacity operation had been attained, yearly production was about thirty thousand tons of copper from two million tons of ore. As additional material of 2 per cent grade could not be found, the main orebody was rapidly exhausted. Large reserves of material of a much lower grade were known to exist, but profitable operation was not believed possible. In 1924, when the situation became acute, *Mineral Industry* sponsored the statements, in its annual review of copper mining, that "The main orebody, averaging about 2 per cent copper, has enabled Miami Copper to earn and pay dividends of $2 annually on its 747,114 shares, all through the depressed metal markets of the last five years. But to continue to earn and to pay these dividends on ore averaging only a little above 1 per cent copper and on a 14-cent market is seemingly impossible."

The Messrs. Lewisohn, who control the property; Mr. Channing, who directs it; and Mr. Maclennan, who manages it, were willing to attempt what seemed impossible, however. The caving method of mining was adopted and put into practice in 1925; the concentrator was enlarged first from 7,500 tons daily to 10,000 tons, and subsequently to 12,000 tons; and operations were started on the low-grade orebody, consisting of 36,000,000 tons of 1 per cent copper. In 1925, dividends were $1.25; in 1926, $1.125; in 1927, $1.50; and in 1928, $1.50. At present they are at the rate of $2 a year. In 1927 the company made an operating profit of $1,268,820 on a 13-cent market and from material that averaged not "a little above 1 per cent copper" but only 0.855 per cent copper. Ore reserves were increased from 36,000,000 tons to 99,000,000 tons of 0.88 per cent copper, despite the fact that about 4,000,000 tons was extracted yearly. Thus, at Miami, was the "seemingly impossible" accomplished in the space of three years.

And now Mr. F. W. Maclennan, manager of the property, releases an announcement: "To bring the tonnage production of the property up to a point commensurate with the tonnage in ore reserves, it was decided in the spring of 1928 to enlarge the capacity of the production plant from 12,000 to 16,000 tons per day." If past records mean anything, this step foreshadows increased profits for the company, regardless of whether copper sells at 19 cents or 13 cents a pound.

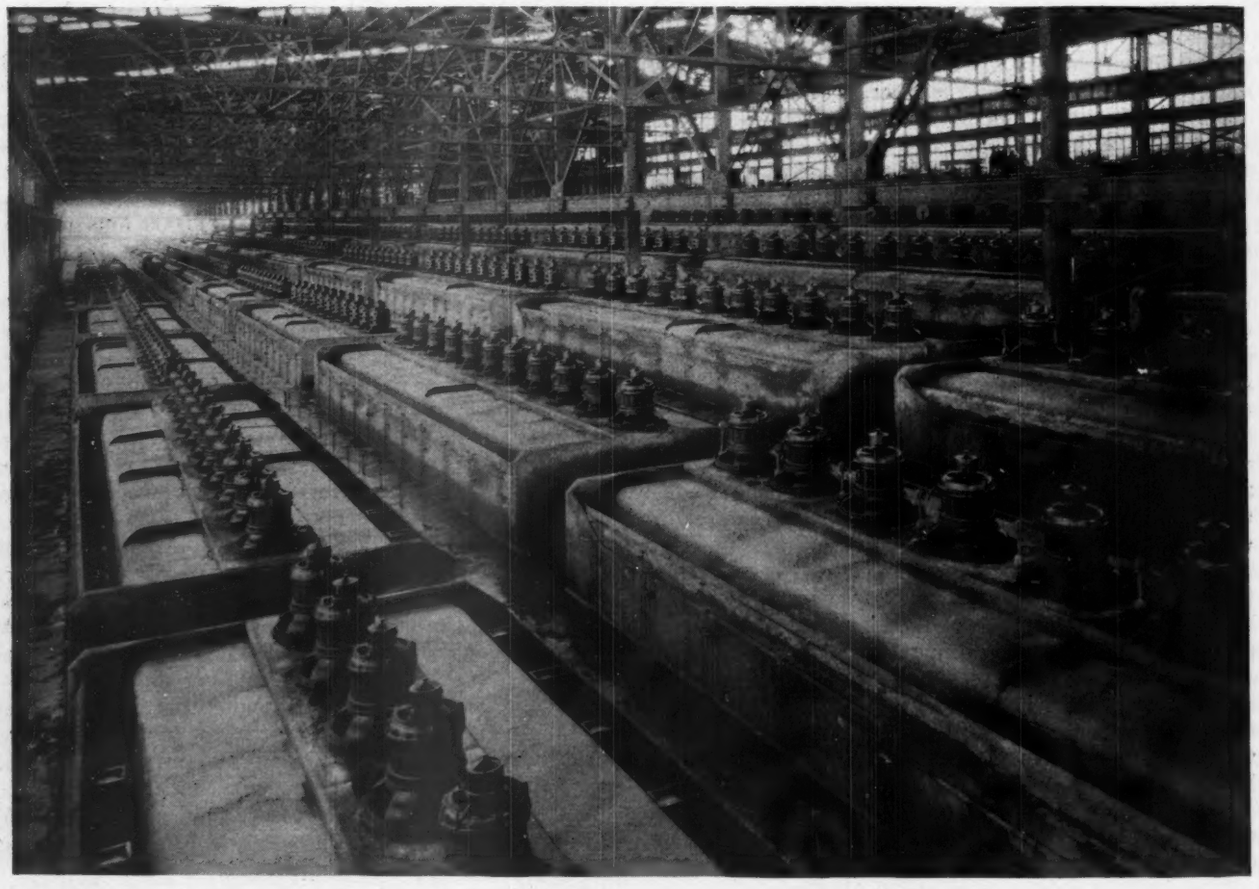
The moral of the achievements of Miami is one of warning to prognosticators to speak cautiously where capable and experienced mining engineers are at work. To attempt to categorize the possible and the impossible in the exploitation of low-grade copper mines seems as futile as to mark limits for the radio or the airplane.

As Dr. George Otis Smith pointed out in his address at the Institute banquet recently, the public is not as readily appreciative of the engineer's work as of the scientist's, but that the engineer's contribution is both tangible and important is evidenced by just such accomplishments as those that have made Miami one of the world's most remarkable mines.

Surface plant and townsite at the Arthur concentrator, situated on the shores of Great Salt Lake near Salt Lake City

Arthur Concentrator of Utah Copper

In the flotation department, which contains 700 Janney machines equipped with individual motor drives and capable of treating 30,000 tons of ore daily



Why Domestic Manganese Should Be Adequately Protected

The Situation from Minnesota's Viewpoint

By CARL ZAPFFE
Manager, Iron Ore Properties, Northern Pacific Railway Company, Brainerd, Minn.

THE American Manganese Producers' Association petitioned in January, 1929, for an increase in the existing tariff on manganese-bearing ores. Bethlehem Steel Corporation has presented a brief and argues for removal of the present tariff.

To explain why Minnesota is interested in having a tariff, we may and shall take several arguments in the Bethlehem company brief and present a discourse thereon.

To understand the whole situation, it is necessary to present the fundamental matters that give rise to the arguments presented by either side. These are as follows:

1. The United States lacks manganese ore comparable in grade and quantity to that of the ores obtainable from foreign sources.

2. Large quantities are needed in the United States each year.

3. Good steel cannot be made without using manganese in the form of the alloy ferromanganese.

4. Manganese must be introduced into the steel in the form of metal and not as ore. That involves the ferromanganese maker.

5. Manganese is a strategic or war mineral and it tops the list as the most important war mineral.

6. Nobody has been able to make or provide a suitable substitute for manganese.

7. The lack of domestic high-grade ore is of national importance and fraught with great danger to the country.

8. Supplies of low-grade ores and leaner material in the United States have never been estimated in full, but are admittedly of immense magnitude in tonnage.

9. The problem is solely one of manufacturing high-grade ore out of poor material. Steel companies have never made commendable attempts to develop anything along this line.

10. Private individuals outside of the industry have developed processes for beneficiating ores of very low content, and the country can be made safe for an incalculable time.

11. Beneficiating low-grade ores or rock and shipping the products to markets requires tariff legislation to make it pay.

12. Without a domestic industry being developed in times of peace, with financial reward in view for the experimenter, no safeguarding of the United States can be devised as to manganese. In times of stress processes cannot be devised properly in this very difficult problem nor the plants built fast enough to insure us against ruin.

The Cuyuna iron ore district, in Crow Wing County, Minn., does not contain a single ton of high-grade manganese ore. It does contain a greater reserve of manganiferous iron ore than any other similar area in the United States.

The first-named ore should contain about 50 per cent manganese; the second need contain about 2 to 12 per cent manganese, and enough iron to make a total of 50 per cent for the two. The two kinds of ore are used in wholly different manners, nor are they even comparable. The Cuyuna district produces more manganiferous iron ore than any other producing district in the United States, yet these ores will not be discussed.

It so happens that the Cuyuna district contains many millions of tons of lean and useless formation which contains 10 to 15 per cent manganese, but, unfortunately, not enough iron to make a total of 50 per cent and too much deleterious material. Beginning with 1922, Wilson Bradley, of Deerwood, Minn., started a long and serious study, which, after five years of patient effort and the expenditure of nearly $400,000, resulted in developing a process for dissolving the manganese from this utterly useless rock formation and the making of the highest grade of manganese ore ever produced or existing anywhere on this globe. His product contains from 63 to 70 per cent manganese, as against 50 per cent and less for foreign ores. It is a most remarkable achievement. With a tariff, this material becomes the saviour of the United States. Cuyuna formation converted into high-grade ore, and that into ferromanganese somewhere along the Great Lakes, can so greatly contribute to the whole present domestic ferro industry as to make everyone wonder why attempts to use this low-grade formation had not been made before.

Plans to start such an industry are now being made by a very strong and long-established institution. No more experiments are necessary. Everything about the process has been patented. H. Brassert & Company, Chicago, the foremost consulting iron and steel engineers of the United States, are associated with Bradley and are handling all the engineering and economic features of this development.

The work being done by the state and by the Bureau of Mines, at Minneapolis, is developing a method whereby heat is used (unlike dissolving the manganese with

---

An answer to the brief asking for the removal of the tariff on manganese filed with the Ways and Means Committee of the House on Jan. 14 by the Bethlehem Steel Corporation on behalf of the steel producers of the United States.

liquids as Bradley did) and, also, is an attempt to make ferro from the ores which are now actually being mined and shipped and are termed manganiferous iron ores, as distinguished from ores of higher manganese content and known as manganese ore.

Bethlehem Steel's Argument Against Tariff on Manganese Fallacious

The various points in the argument contained in the brief filed by the Bethlehem Steel Corporation in January with the Ways and Means Committee of the House are taken up separately and answered in the following. They are considered in the order in which they are presented in the brief.

"The representatives of the steel industry asserted in 1922 that no satisfactory domestic supply (of manganese) was available and that no duty would create what did not exist."

Answer. There never was a supply of suitable ores in their natural conditions; but there is an immense supply of low-grade ores and otherwise useless material which experiments made since 1922 have proved possible of conversion into better ores than any foreign ores. The duty imposed on foreign ores encouraged the making of those experiments. The experiments were not even attempted by the men in the steel industry who are most in need of such ores. The steel makers have no boast to make; and derogatory remarks offered tend to depreciate the work done by others.

"Under this (present) excessive duty no development of an industry in manganese ore has occurred; no product has been produced, and the American steel industry has obtained its supply from abroad to the extent of 93 per cent of its requirements."

Answer. Experiments on Montana and Minnesota crude ores were concluded during the summer of 1928. A different process was developed for each state by two different and unrelated groups. Montana has a large reserve of low-grade ore of a different type; a plant was built in the spring of 1928 capable of producing 72,000 tons of 57 per cent ore. American steel makers have not been willing to pay even the same price for this better American product that they pay for the poorer imported product. Bradley's group did not advance far enough until recently to justify presenting their set-up to commercial interests. Therefore, statistics of production are of no value.

"Responsible government bureaus and private interests agree that no satisfactory supply of manganese ore of ferromanganese grade exists in the United States. Substantial supplies of low-grade manganese ore do exist, but are not suitable for the production of ferromanganese. These low-grade ores would probably be used in the event of national emergency, when cost means nothing, and, if it became absolutely essential, would supplement the ordinary means of producing ferromanganese. These low-grade ores have a definite present use in their natural condition in the production of a high-manganese pig iron."

Answer. It is admitted that no satisfactory supply of high-grade ore exists in the United States. It is correct that substantial supplies of low-grade ore exist, and they are being used to make high-manganese pig iron. Such is the manganiferous iron ore of the Cuyuna district, and the Bethlehem company itself uses much of it. It is also correct to this extent, that these Cuyuna ores cannot be made into ferromanganese by present furnace methods. However, the Bureau of Mines has a skeleton plan according to which ferro can be made from these ores in time of stress, and may yet develop it for use in peace times. The Bethlehem company, however, ignores that in its own Cuyuna mines are large tonnages of ore, not now called manganiferous or low-grade iron ore, but termed lean manganiferous formation, which is the very thing it throws away and Bradley's process uses and is intended for. The Cuyuna district has millions of tons of this and the whole United States is over-supplied with this sort of material. None will deny that.

"I (Mr. C. A. Buck) know personally from 40 years' experience that every effort has been made by us in that direction, and I would urge the committee to reflect on the fact that the steel industry itself would voluntarily, without any tariff or other legislation, turn to domestic source of materials if such materials existed in proper quantity, quality and location."

Answer. Forty years is too long. The story begins with only the past five years. The steel industry has not done a single thing toward developing a process (with or without legislation). Numerous outsiders did the experimental work in every place in the United States where experiments have been tried, and with results beneficial to their respective localities. The last word quoted is "location"; as will be shown later, location of the Bethlehem ferro plant is the prime if not sole factor in the attitude taken, where the expression "quantity, quality and location," with respect to the ores, should be ignored unless the plant and the market are simultaneously considered.

"We believe in the policy of the free importation of such natural riches and that any legislation which places a handicap upon their importation is short-sighted and improvident. . . . Tariffs on such riches as manganese ore distinctly tend to the utilization of our own natural wealth in an unnatural and uneconomic way."

Answer. Location of the Bethlehem plant at a favorable position to tidewater and imported ores is a very essential thing to bear in mind when the above statement is made. Also, when manganese is placed by the War Board as the top mineral of strategic minerals. and is not replaceable by any other substance, it behooves American citizens to do everything in their power to make their country independent of foreign supplies and secure for all time. Development of new processes and treatment of low-grade manganese ores have been attempted in several states, especially Montana, Minnesota, Georgia, and Virginia; and, as in Montana and Minnesota, where immense tonnages exist, useless material has actually been converted into very high-grade ore and in a decidedly natural and very economic manner. The quotation displays total evasion, if not ignorance, of what has been attempted and accomplished. It is absurd to say that a tariff tends to the utilization of a natural resource if it does not exist, as claimed; for there is then none to use. Even though all admit that a little does exist, nobody concerns himself about it, because it is so little and might as well be disregarded so far as it may be a factor in even the slightest degree. The problem is one of manufacturing a good ore out of useless material.

"The truth is that the tariff imposed in 1922 on manganese ore was based upon misstatement and misinformation. Advantage was taken of conditions existing during the aftermath of the Great War."

Answer. If misinformation was a factor, the brief shows that the opponent of the tariff is the one who is misinformed. The war demonstrated the absolute necessity for the United States to make itself independent with regard to a commodity which even our allies prevented us from obtaining, and the enemy nations prevented by their blockades and raiders. The aftermath was not a matter of undue excitement but of calm determination to perfect processes to use our abundant but otherwise useless resources. As a result, processes were developed and plants erected, which it is now sought to destroy by removal of tariffs.

"The importation of manganese ore has been necessary since 1922 and will continue to be necessary. Only expensive, unsound, and absurd practices will prevent importation of manganese ore."

Answer. It is correct that importation has been necessary since 1922. It is correct that importation will continue; but duties have never stopped importations, nor is that the thing which is sought. The object is to enable the development of an American ferro industry located inland, using domestic manufactured ores, and making the United States safe at all times. It is absurd in itself to advance "absurd practices" as an argument.

"Thus, geographical location is in itself a protection to a product in its own natural territory against any competition from a distance. As soon as artificial protection is created by high tariffs it immediately throws natural territories out of line. It would seem elementary that it is bad economics to haul a heavy product such as ores for thousands of miles by rail. Yet this is exactly what is encouraged by imposing high tariffs on such products. The eastern users normally will obtain their raw materials from abroad, transported by water to the Atlantic coast. Such imported materials cannot compete with the domestic product in the interior of our country, as the rail haul from the coast inland is prohibitive.

"Similarly, such domestic materials cannot compete with foreign ores on the Atlantic coast, and to make it possible for them to do so, a high tariff must be raised, sufficient to pay the freight by rail on the domestic material to the coast point. If the use of such domestic products is enforced in this manner it seems to us a great national waste of time and thought."

Answer. This is the only statement made in the brief bearing on the economic situation relating to the making and marketing of ferromanganese. Therein lies the real grief and pinch to the Bethlehem company. It is obvious that any new inland enterprise, making ferro, would be a competitor. If we want Minnesota rock converted into ore and that ore into ferro at some point along the Great Lakes, as would obviously follow, Minnesota must be protected by a tariff or the Bradley process will never be possible of application. With this process applied, ferro can be made cheaper at Buffalo, for example, than at any place in the United States, provided a tariff is imposed. That is the only way Minnesota rock can be applied to industrial purposes, and when that is done the United States has the nucleus for the development of a ferro industry independent of foreign aid in times of stress. There is no cheaper transportation in the United States than hauling ore by vessel down the Great Lakes from Superior or Duluth to Buffalo, 988 miles, costing 83c. per long ton, including the cost of unloading from vessel to dock at Buffalo. Furnaces at Buffalo obviate the cost of shipping ore all-rail from Buffalo to Pittsburgh, costing $1.25 for ore loaded into cars, if the same ore were to be used at Pittsburgh. Pittsburgh is the real center in the ferro industry, and it now gets its ores from foreign sources, requiring shipment hundreds of miles by rail from the coast. The iron ores used in Minnesota territory and even in Buffalo are all Lake ores. So why not use manganese ores from the Lake districts? Even manufactured Montana ore can be shipped by rail to Duluth and thence by lake to Buffalo for much less money than when shipping it all-rail from Butte to Pittsburgh, as was done in 1928. Montana ore belongs geographically to the Lake Superior territory and Buffalo.

The Bethlehem company undoubtedly is aware of this proposed, or prospective, development at some such point as Buffalo or the possibility of Pittsburgh makers of ferro falling heir to the Minnesota and Montana supplies of ore, to be converted into ferro at Pittsburgh or possibly Chicago; in which events the Bethlehem company would have competition from domestic sources. The Bethlehem company, situated in the East, is favorably situated as to foreign supplies, is not interested in inland supplies, and would have to meet active domestic competition if any inland project were permitted to rise. Its position is most obvious, but its defense is built around insinuations and weakened by ignoring facts.

Minnesotans should be whole-heartedly in favor of a tariff on manganese. It assures possibilities of utilizing our large tonnages of waste manganese-bearing rocks which can be made a real factor in a thing so vital to the United States as a domestic supply of ore. The tonnage is great and processes are defined; all that remains is the capital investment, which, it seems reasonable to suppose, will be made available if the protection is given which is needed to assure permanency. Nor has that capital had time to get into this development. The additional cost added to steel products because of the tariff is small payment for our citizens to make for national security. National security is the first consideration, and the War Minerals Board of the War and Navy departments will support this point most vigorously, as has been done often in the last ten years by its spokesman, whose remarks are public records.

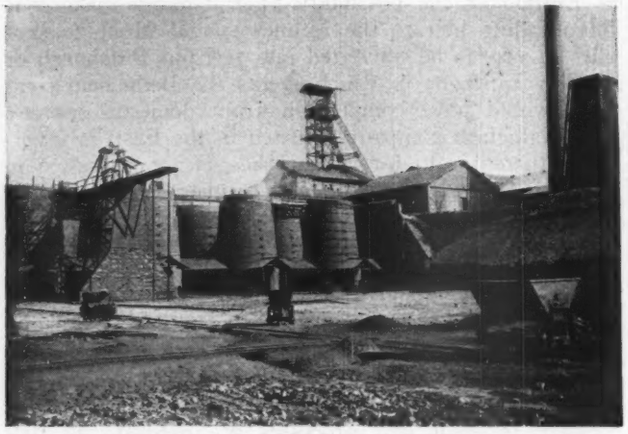
Possible Sources of Tin in Alaska

NO particular dearth can be seen just at present in the world supply of tin. Consumption has expanded greatly, but production has fully kept up with it, so that the Anglo-Oriental group in London is supposed to have found it necessary in recent months to absorb a part of the supply, in warehouses. More than half of the tin that is mined comes to the United States, but of the 80,000 tons or so that this country uses, it produces something like ten tons, all of which has in recent years come from dredge operations in Alaska. Is there a chance of finding the lodes from which these placer deposits came and are they likely to be worked economically? Dr. E. N. Patty, who is Dean of the Alaska Agricultural College and School of Mines, will describe the tin districts of Alaska in an early issue.

Iron Ores of Northwestern France

By Edwin C. Eckel
Consulting Geologist, Washington, D. C.

LAST SUMMER and fall it was possible for me to examine, in considerable detail, one of the largest though least-known iron-ore fields of the world—that of Normandy and Anjou, in northwestern France. The term "largest" refers not to its present output, which is approximately 2,000,000 tons annually, but to its probable ore reserves, which give it rank among the half-dozen great ore regions of the world. Likewise, the term "least-known" requires qualification, for we have the monumental work of Cayeux on the microscopic characters and origin of these ores; and we have a number of widely variant estimates of ore reserves. Definite knowledge of the current competitive possibilities of this field has been lacking, however, this being a matter of importance, since at least one North American company cut its export ore prices and guaranteed uneconomic grades in order to meet what clever German ore purchasers claimed to be easily attained French prices and grades. Setting aside data and conclusions on points of merely private interest, there remain certain matters of general interest which are briefly summarized in the present article.



Shafthouse and kilns at Lorchamp Mines, Normandy

Location and General Outline

The working mines are all located within an area of about 100 miles from north to south by 30 miles from east to west. Caen on the north and Segré on the south are at present extreme limiting points. The actual ore beds are of far wider extent, reaching well into Brittany on the west; so in future it is probable that the producing area will be greatly extended.

The west France ores are oölitic carbonates, hematites, and magnetites, occurring as sedimentary beds in the Ordovician. The worked beds are from 2½ to 10 ft. thick usually; they vary in number and differ sharply in their exact vertical position in the Ordovician series. Longitudinally, single definite beds extend for miles—sometimes for tens of miles; they may indeed have far greater continuous extent than this, but that is yet unproved. Originally deposited as silicates or carbonates, perhaps in some instances as oxide directly, their present mineral composition is fixed by the extent of the regional metamorphism which different areas have undergone. The region is extensively folded and faulted; dips of 30 deg. are normal; vertical and overturned beds occur in large areas. There is no evidence of later enrichment, and the surface weathering effects are limited and shallow. Owing to a thousand years of operation, surface outcrops are rare; but there are extensive underground operations on several different beds and in widely scattered areas. The Armorican region has been long a favorite ground for studies of a specialized sort; we have, for example, a profusion of paleontologic data, and practically not a word describing the rocks in which the fossils were found; we have, for the iron ores, very careful genetic studies, based on a mass of chemical and microscopic observations, and not a single section showing the location of the various ore beds in relation to the general series; we have, in short, field work reduced to its minimum and laboratory geology pushed to the extreme. All of which will be readily comprehensible to anyone who has lived through the year in Brittany—which, for climate, ranks a shade above Labrador and well below Patagonia.

The Ordovician Series

The Ordovician of the iron-ore region is made up of the following formations, from the top downward:

4. Riadan shales.

3. May sandstones; mostly sandstones, with subordinate intercalations of shales.

2. Angers shales and slates; metamorphosed roofing slates in Anjou; normal shales in Normandy.

1. Armorican sandstones and quartzites; quartzites in most of Anjou and Brittany; normal sandstones where present in Normandy. Typically developed in west Brittany, where a thickness of 1,500 ft. is attained. Thins eastward; and disappears entirely in the Caen region of Normandy.

As will be seen later, we are chiefly interested in the Angers series, which contains the bulk of the worked and workable ores of the region. The May sandstones above and the Armorican sandstones below are of interest chiefly as determining prospecting limits, though at points ore beds of less importance have also been found in these two series.

Table I—Analyses of Magnetites and Hematites, West France

	1	2	3	4
Metallic iron	53.69	52 to 53	48.32	46 to 51
Manganese oxide	0.30	n.d.	0.32	0.5
Phosphorous	0.96	0.6 to 0.7	0.72	0.6 to 0.7
Sulphur	N.d.	N.d.	0.05	N.d.
Silica	11.96	10 to 12	13.80	14.0
Alumina	4.60	3.0	N.d.	3.25
Lime	2.57	2.5	2.54	2.5
Magnesia	0.48		1.03	
Water and loss	5.45	3.0	4.07	5 to 6

1. Segré; export shipments 1928; chiefly magnetite; part concentrated.
2. St. Remy; range; crude hematite as shipped.
3. May; actual shipments; crude hematite.
4. May and St. Andre; usual range; crude hematites.
N. d., not determined.

In the literature of the subject there is a tendency

toward differentiating sharply between the ore horizons in Normandy and those in Anjou. Practically all maps and publications speak of the Normandy ores as being interbedded in the Angers shales, and of the Anjou ores as being interbedded in the Armorican sandstones. In at least one instance an author goes further, and for the sake of even sharper differentiation refers to the Norman ores as Silurian and to the Angevin ores as Ordovician.

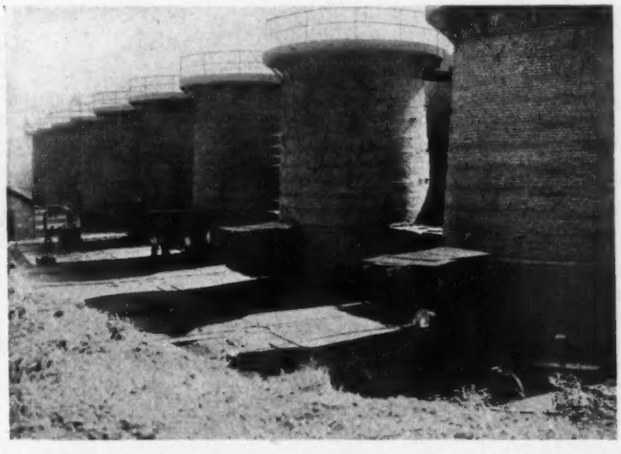
Table II—Analyses of Carbonates, Crude and Roasted, West France.

	5	6	7	8
Metallic iron	39 to 40	48 to 50	50	48.15 to 49.25
Manganese	0.32	0.40	0.40	0.56
Phosphorus	0.67	0.80	0.72	0.67
Silica	11.0	14.0	13.7	13 to 14.5
Alumina	4.3	4.5	7.4	N.d.
Lime and Magnesia	4.5	4.5	3.5	N.d.
Water and Loss	26.60	0.8	1.8	N.d.

5. La Ferriere des Etangs; crude carbonate as mined.
6. La Ferriere des Etangs; roasted carbonate.
7. Lorchamp; roasted carbonate.
8. Halouze; roasted carbonate; usual range.
N. d., not determined

As a matter of fact, when we come to examine the ores on the ground, it is almost immediately obvious that such sharp differentiation does not exist in fact, so far as the ore horizons of the two provinces are concerned; and that the reality is more complex than the established picture. To begin with, all the worked ores are purely Ordovician in age, and occur well down in that series. Measured by thickness of deposition, the iron ore beds are somewhere around the top of the lower third of the Ordovician deposits. In point of time they would occupy a still older position, inasmuch as the Ordovician sediments which underlie the ore beds are almost entirely sandstones, whereas those which overlie the ores are chiefly shales. In at least one area, which is frankly unusual, the worked ore bed is almost directly on top of Cambrian beds.

In fixing the position of the ore beds in the series, it



Calcining kilns for carbonate ores, La Ferriere des Etangs, Normandy

is now possible to make two statements, one giving a wide range of possibility and the other giving a rather sharp definition in actual fact. These are:

1. In one area, ore beds occur at least 250 ft. *below* the contact of Armorican sandstone with Angers shale. In another area, ore beds occur about 350 ft. *above* that contact. There is therefore a possible range of at least 600 ft. in the vertical position of the ore beds.

2. The richer workable ores are, however, far more limited in their vertical range. The three mines of highest grade all work ore beds which are on, or within a few feet of, the exact Armorican-Angers contact. And in practically every other mine now in operation, the worked ore bed lies not more than 100 ft. from that contact, and in every case (except Segré), *above* it.

So out of the mass of data now available we can come to some such tentative conclusion as this: The main ore bed is likely to be located on the Armorican-Angers contact; the second most favorable horizon is in the Angers shales about 75 to 100 ft. above the contact. It is definitely uncommon to find worth-while ore beds lying outside this hundred feet of vertical range.

Owing in part to original differences in deposition, but more largely to differences in extent of regional metamorphism, the iron ores of west France are found as carbonates, as hematite, and as magnetite. The richest ores —and those which are found in the export markets—are those from Segré, St. Remy, and May. Of these the Segré ore is a magnetite; it is shipped in part after mere picking, in part after a slight magnetic concentration. St. Remy and May ores are shipped crude, with merely hand picking in some portions of the product. The carbonates—or mixed carbonates and hematites—are of course all calcined in vertical kilns before shipment. The best shipping grades of ores of this type are those from La Ferriere des Etangs, Halouze, and Lorchamp.

Typical analyses of actual production from these different mines are shown in Tables I and II, separated according to type of iron mineral.

As a rough guide to the general average of the whole region we may note that the seven shipping ores whose analyses are given in Tables I and II will average, for their three main constituents: metallic iron, 50.14 per cent; silica, 13.17 per cent; and phosphorus 0.74 per cent. The roasted carbonates are definitely lower in iron and higher in silica than the hematites and magnetites: 49.23 per cent vs. 50.75 per cent iron, and 13.82 vs. 12.69 per cent silica, respectively.

The export ores are shipped via Nantes or St. Nazaire for the Segré output and via Caen for the output of all other mines. Their chief market at present is Germany; in pre-war days England entered also as a consumer and will doubtless do so again with better steel conditions in Great Britain.

Sponge Iron Facilitates Precipitation of Lead and Copper

THE porous properties of sponge iron have been utilized by the U. S. Department of Commerce in a series of experiments looking toward the improvement of the process of precipitation of lead and copper from solution. The sponge iron is substituted for coarse scrap iron, which is relatively awkward to handle and exposes only a small amount of surface to pregnant solutions. Products containing more than 80 per cent of lead were made, and valuable information relative to the precipitation of copper from various solutions was obtained. The experimental work was conducted at the Southwest Experiment Station of the U. S. Bureau of Mines, Tucson, Ariz., and at the Bureau's Intermountain Experiment Station, Salt Lake City, Utah, under co-operative agreements with the University of Arizona and the department of mining and metallurgical research of the University of Utah. Results of the experiments are described in Bulletin 281, by G. L. Oldright, H. E. Keyes, Virgil Miller and W. A. Sloan, just issued by the U. S. Bureau of Mines.

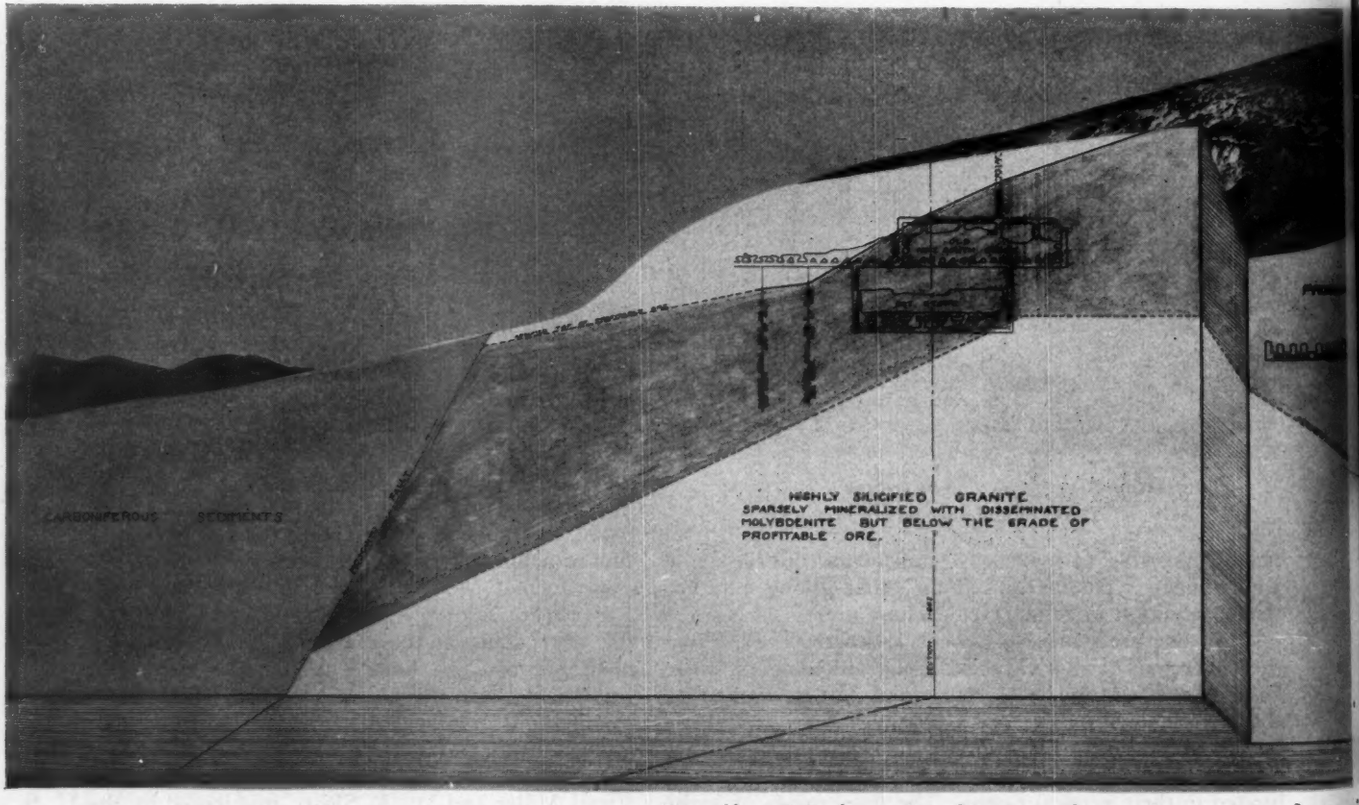
MINING *Molybdenum Ore*

By WILLIAM J. COULTER

General Superintendent Climax Molybdenum Company, Climax, Colo.

With the recent development of the Climax mine, in Colorado, which is the largest known source of molybdenum, the United States has displaced Australia as the leading producing country, in fact being the only one of present importance. Molybdenum is a metal of comparatively recent introduction to commercial technology, but one for which there is a rapidly increasing demand. The Climax mine, which will be discussed in this article, is unique in many respects, and the practice of mining the ore, and of concentrating it, which will be described in a succeeding article, is of particular interest.

CLIMAX, Colo., is at Fremont Pass, on the crest of the continental divide, at an elevation of 11,320 ft. Rail transportation thence is provided by a narrow-gage branch of the Colorado & Southern Railroad, which operates between Leadville and Denver, Climax being 12 miles from Leadville and 112 miles from Denver. The railroad gives daily passenger train service from both terminals and freight service twice a week throughout the year. A switch from the main line and a 500-ft. spur put freight cars alongside the mill. The mine is approximately one mile from the mill, at an elevation of 12,000 ft., the ore being transferred by a cable tram. A good automobile road is maintained between both camps, over which practically all of the



Bartlett Mountain dissected to show ore deposit

A typical haulage drift in the Climax Mine

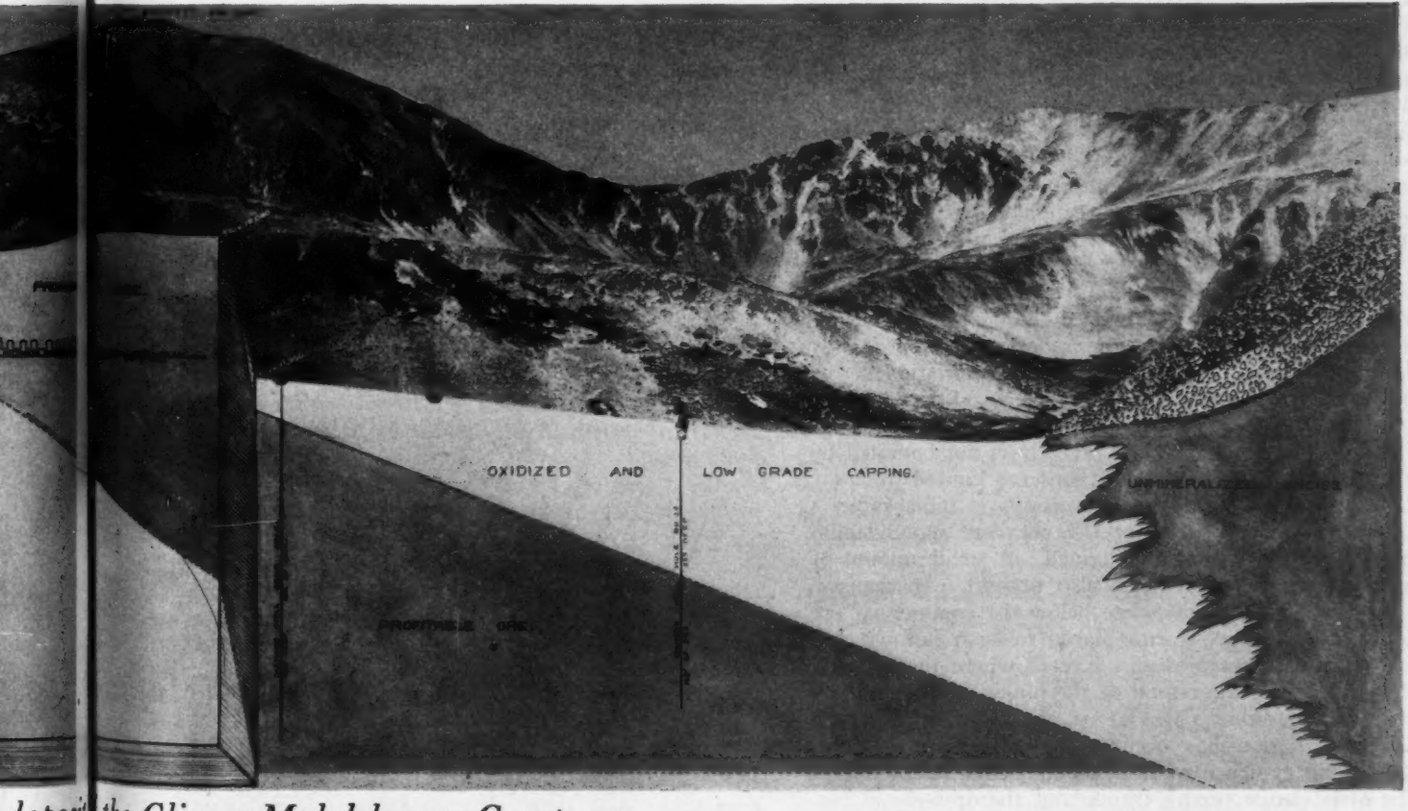
...AT CLIMAX, COLORADO

freight to the mine is handled. An excellent state highway between Leadville and Denver passes through Climax, the trip from Climax to Denver being made by automobile in four and one-half to five hours.

Although comparable in altitude to the San Juan district of southwestern Colorado, winter conditions at Climax are not severe. At no time does the weather interfere with mining or milling operations; nor with transportation, except for a few days; and in some winters not at all. The topography is such that there are no snowslides at either mine or mill.

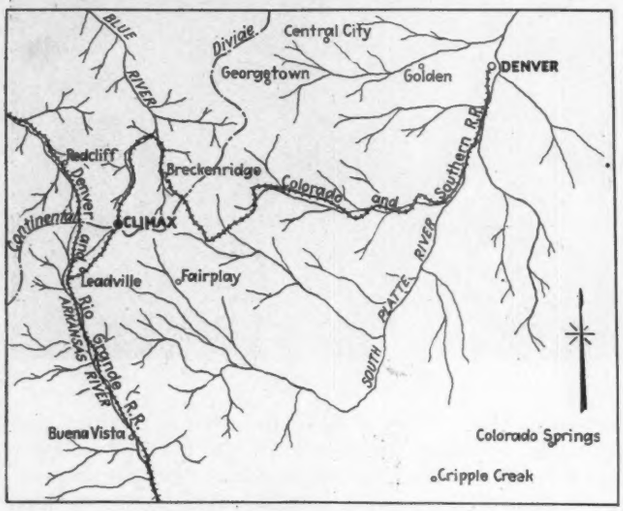
One of the World's Great Mines

In "Mineral Resources of the United States, 1918," published under the auspices of the U. S. Geological Survey, this statement appears: "So far as it is already explored, the deposit at Climax can probably supply 100,000 tons (200,000,000 lb.) of elemental molybdenum." Diamond drilling and development work since the publication of that statement have fully borne this out, and a tonnage approximating some of the porphyry copper deposits may be developed ultimately. The area at present developed for mining contains over 4,000,000 tons of ore, but several times this tonnage has been indicated by diamond drilling, which is carried on continuously and is still far within the zone of mineralization. However, owing to the large developed tonnage, no very active diamond-drilling campaign is carried on. One diamond drill is kept working continuously, with the result that the definite reserves proved every year are many times the tonnage mined. Mining from areas developed by diamond drilling has proved the reliability of the drilling results. The present production results in 3,000,-



the Climax Molybdenum Company

000 lb. of metallic molybdenum per annum. With the large blocked-out tonnage and the reserves indicated by drilling, the mine is in a position to take care of any possible increased demand for the metal.



Map of central Colorado, showing location of Climax

The molybdenite occurs remarkably evenly disseminated through an area of silicified Pre-Cambrian granite. It is not associated with aplite or pegmatite, nor in veins, Mr. Lindgren being to this extent in error in his last edition of "Mineral Deposits," p. 861, under the heading "Mineral Deposits of the Pegmatite Dikes." The main mass of the granite shows little, if any, alteration, but in the vicinity of the ore deposition the alteration to a highly siliceous rock has been intense. The altered area is intensely brecciated and fractured, and it is believed that, following this, the interstices were filled with siliceous and mineral-bearing solutions. Few dikes have been encountered in mining, but these dikes, of quartz porphyry, are definitely pre-mineral. The dikes are much altered and the mineralization of them has been slight. Several minor faults occur, but with the exception of one major fault, the displacements have been negligible. In the major fault the ore has been found on the other side, but the direction and extent of the throw have not been determined.

A mineralized area approximately 2,000 ft. square has been partly developed by mine workings and diamond drilling, which has so far proved the deposit to be continuous. Part of the original orebody was removed by glaciation, this largely accounting for a variation in the thickness of commercial ore between 100 and 450 ft. Recent diamond drilling shows that the ore zone is dipping to the northwest. The orebody is not bounded by definite walls, so mining operations are limited by assay values. The uniformity of the assays is remarkable, a consistent average of about 0.9 per cent molybdenum sulphide (MoS_2) being maintained. A small amount of pyrite, about 1 per cent, is also present. In general, silicification is more complete below the commercial ore zone, whereas above it, unreplaced feldspar is more evident as a rock constituent. Except where the orebody outcrops, and in the region of the major fault, the presence of the oxide (MoO_3) is sparingly in evidence. Where oxidation has occurred in the upper horizon, there is no evidence of molybdenum enrichment below. The molybdenite occurs throughout the orebody in two characteristic forms: as comparatively coarse plates or veinlets along fracture planes, and as mineral so finely disseminated through the quartz gangue that a blue tinge is imparted to the quartz, the mineral only being recognized as molybdenite by use of the microscope.

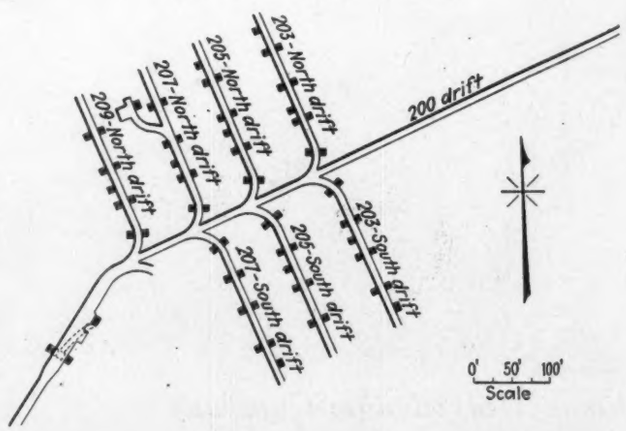
Mining by Shrinkage Stopes

So far, the mine has been developed from two levels, but as diamond drilling has proved ore 450 ft. below the lowest level, other levels ultimately will be driven. The upper level has approximately 100 ft. of backs and a large portion of the tonnage from this level has been mined by shrinkage stope and glory-hole methods. The present lower level is 200 ft. below the upper level, and all the remaining ore to the surface in this particular block will be mined from this level.

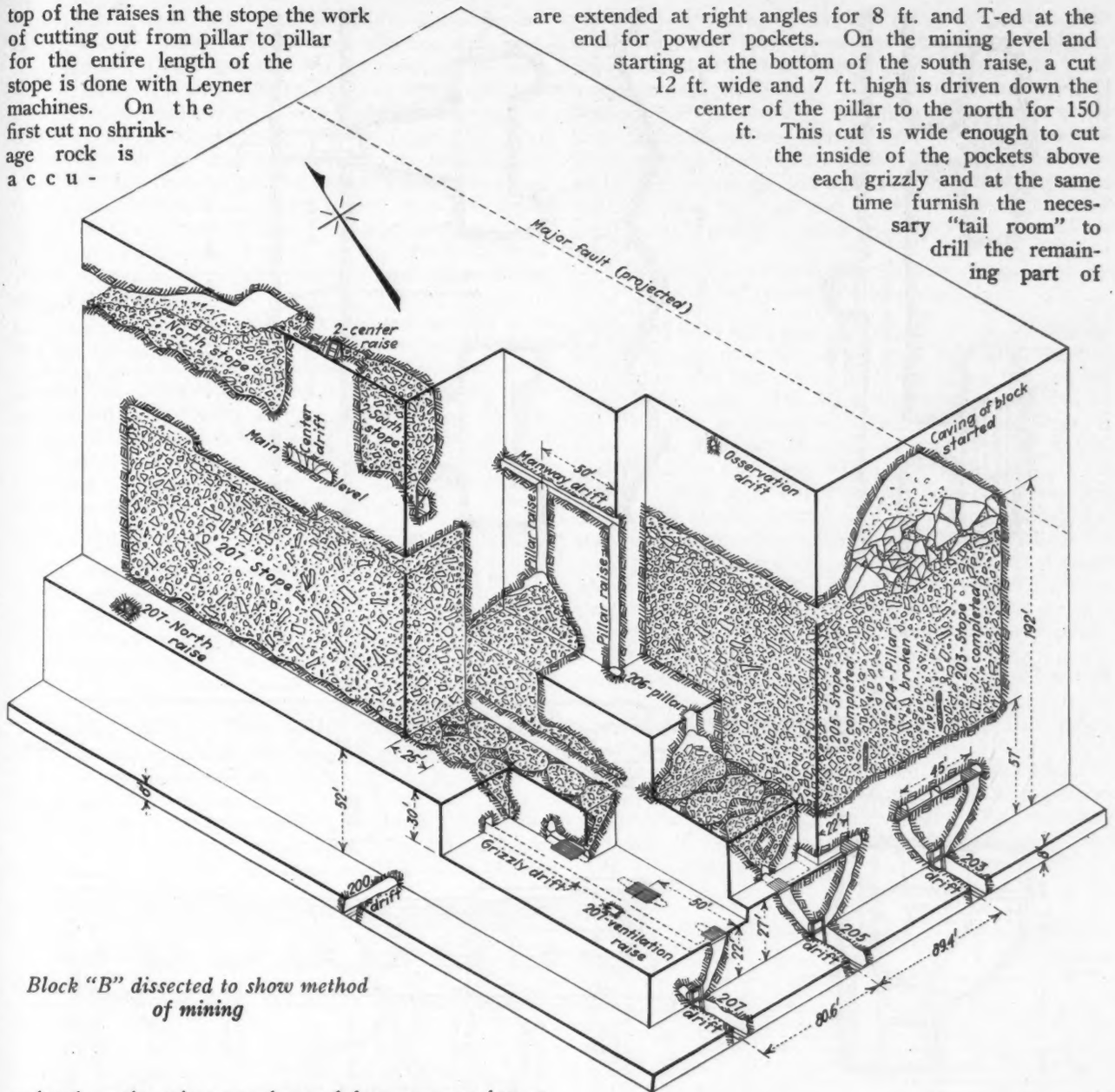
As can be seen from accompanying sketches, the mining method is a combination of parallel shrinkage stopes 400 ft. long by 50 ft. wide, with intervening pillars 40 ft. wide. The pillars are being recovered by a method of coyote-hole mining, which is fully described later in this article. The block now being mined contains several million tons, and will be taken out with four stopes and four pillars, of the dimensions just given. This block is cut in the center by the main adit, 9 x 9 ft., from which drifts 250 ft. long are driven each way on the center line of the stope and pillar. At 100 ft. from the main adit on each side, and on the pillar side of the drift, a service raise is put up 35 ft. to the grizzly or bulldozing level. A 5 x 7-ft. drift is then driven from the top of these raises, also on the center line of the stope and pillar directly over the haulage level below. Raises are then driven from the haulage level at 50-ft. intervals; one raise is driven into the stope block to intersect the center of the stope at the grizzly level and directly across from it, and another similar raise is driven to the center line of the pillar. This program thus provides for eight stope chutes and eight pillar chutes, together with two service raises to the grizzly level from each haulage drift. Short drifts are next driven from the grizzly drift to cut the top of the chute raises, and room is then made at the top of the raises for a grizzly 15 ft. long and 8 ft. wide. These grizzlies are made of 90-lb. rails with 12-in. openings, and are anchored to and supported by 10-in. I-beams. From each end of the grizzlies two raises are driven; for the first 12 to 15 ft. these raises are about 6x6 ft., after which they are belled out and carried up until the tops of all the raises for either the stopes or pillars tie into 25-ft. centers.

Development work for the stopes above the grizzly level is done in advance of that for the pillars. At the

The 200 level of Block "B"



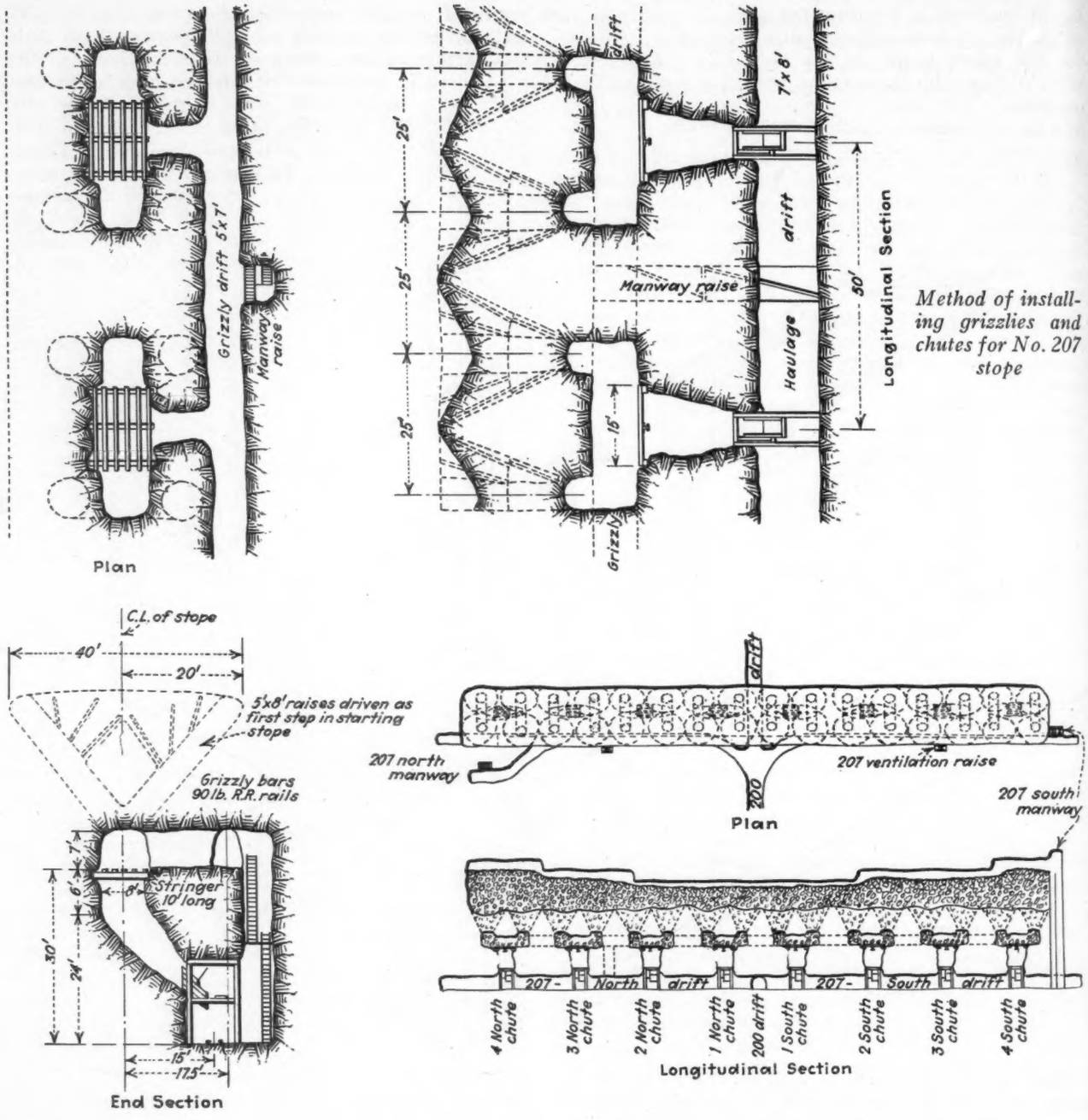
top of the raises in the stope the work of cutting out from pillar to pillar for the entire length of the stope is done with Leyner machines. On the first cut no shrinkage rock is accumulated, so the raises may be used for manways, but at about the same time as the first cut is made, two end raises are started from the lower level. These are vertical raises driven in the pillar about 6 ft. off the stope line at each end of the stope. When the second cut is taken from the back of the stope, and shrinkage ore starts to accumulate, a short drift is driven to connect these raises with the stope, and from then on the stope is serviced from these two raises with the aid of Tugger hoists until the ground is broken through to the upper level.



Block "B" dissected to show method of mining

The initial development of the pillars is identical to that for the stopes. At the northern limit of the pillar and on its center line, a raise is driven to the back of the ore, a similar raise being put up at the south end of the block. These raises start from the mining level, which is approximately 25 ft. above the grizzlies, and they are connected with the upper level for ventilation and for the passage of supplies. At vertical intervals of 20 ft. to the height of the pillar, small coyote drifts, 3 x 4 ft., are then driven down the center line, the drift from each raise being 200 ft. long. At 15-ft. centers similar crosscuts are extended at right angles for 8 ft. and T-ed at the end for powder pockets. On the mining level and starting at the bottom of the south raise, a cut 12 ft. wide and 7 ft. high is driven down the center of the pillar to the north for 150 ft. This cut is wide enough to cut the inside of the pockets above each grizzly and at the same time furnish the necessary "tail room" to drill the remaining part of the pillar on either side, which averages 12 to 14 ft. in thickness. The side pillars are then drilled for the entire distance, and at each set-up a test hole is drilled into the muck in the shrinkage stope on each side, the round then being drilled about 2 ft. shorter than the test hole. As the shooting of the coyote holes is started on practically a vertical line from the south end, this undercutting on the mining level is advanced in stages to give the pillar a substantial heel on which to rest. The last thing to be done is to cut the pillar off on the south end; this is done from the south raise in two stages, the raise first being lengthened out to permit "tail room" for long steel, after which drilling is carried to the muck on either side. During this work the shrinkage muck is taken care of by drawing the south pockets above this grizzly.

Shooting of the coyote holes is next in order. The first vertical line of coyote holes, together with 15 ft. of Leyner holes drilled from the mining level, are shot



Method of installing grizzlies and chutes for No. 207 stope

simultaneously, with electric caps. The swell is drawn down and the operation repeated until the northern limit is reached. The coyote drifts are driven with Ingersoll-Rand R72 machines, and the Michigan cut is used, which consists of five holes straight in. One miner has two working places and puts in two of these rounds per shift, averaging 3½ to 4 ft. in each face. Although as this is written the development of the first pillar is well advanced, shooting of the coyote holes has not started, but an estimate made by engineers of the duPont and Hercules powder companies indicates a cost of 13½c. per ton for breaking ore in the pillar. This includes the driving of the coyote drifts and the cutting off of the pillar at the bottom. An additional 7½c. per ton is the estimated cost of the development work, thus bringing the total cost for the pillar muck to 21c. per ton. In each of the T's will be placed 160 lb. of powder, consisting of 50 per cent gelatin with one stick of 60 per cent nitroglycerin in each charge for a primer. The estimated cost of powder and blasting supplies is 4½c. per ton. Tamping of the powder drifts is important, gouge from the fault zone being used for this purpose. A shattering effect is necessary. The spacing of the powder drifts, and the grade of explosives, may be changed with experience, but it is believed that the present plan is on the conservative side, possibly leading to further spacing of the coyote drifts and powder charges, with a consequent reduction in breaking cost per ton.

In this mine the ground is hard and uniform, being practically all quartz, which, after it is once drilled, breaks exceptionally well. There are no dikes in the entire block, and few slips or breaks occur, so that the ground stands well. Ingersoll-Rand X71 drills are used in the stopes and R72 machines in the pillars. Fifteen- to thirty-foot faces are carried in the stopes, and two machines work against the same breast. Each machine advances along the pillar line, and they both hook the ground to the center of the stope. Sixteen- to twenty-

foot holes, spaced 4½ to 5 ft. apart, are drilled in the breast, and from two shifts drilling with one machine a breakage of 500 tons per round is common; occasionally it will run up to around 1,000 tons. The tonnage broken per pound depends a good deal on the bellies on the center of the stope and in the over-breakage. In all of these holes 50 per cent powder and clay tamping are used, as it has been found that a better shattering effect is obtained than with lower-grade powder at the initial break, resulting later in a lower secondary breaking cost on the grizzlies. Four tons of ore are broken in these stopes per pound of powder, giving a breaking-explosive cost of 4c. per ton.

The average number of tons broken per machine shift in the stopes is 160. Tonnage broken, over half of which is accumulated as shrinkage, runs over 60,000 tons per month, this being broken and the development work maintained, with a daily average of twenty-one machine shifts. The operation at Climax is now the largest in the State of Colorado. During the last ten years only one fatal underground accident has occurred, and no accident has resulted in permanent disability.

New Drill Column a Feature of Stope Equipment

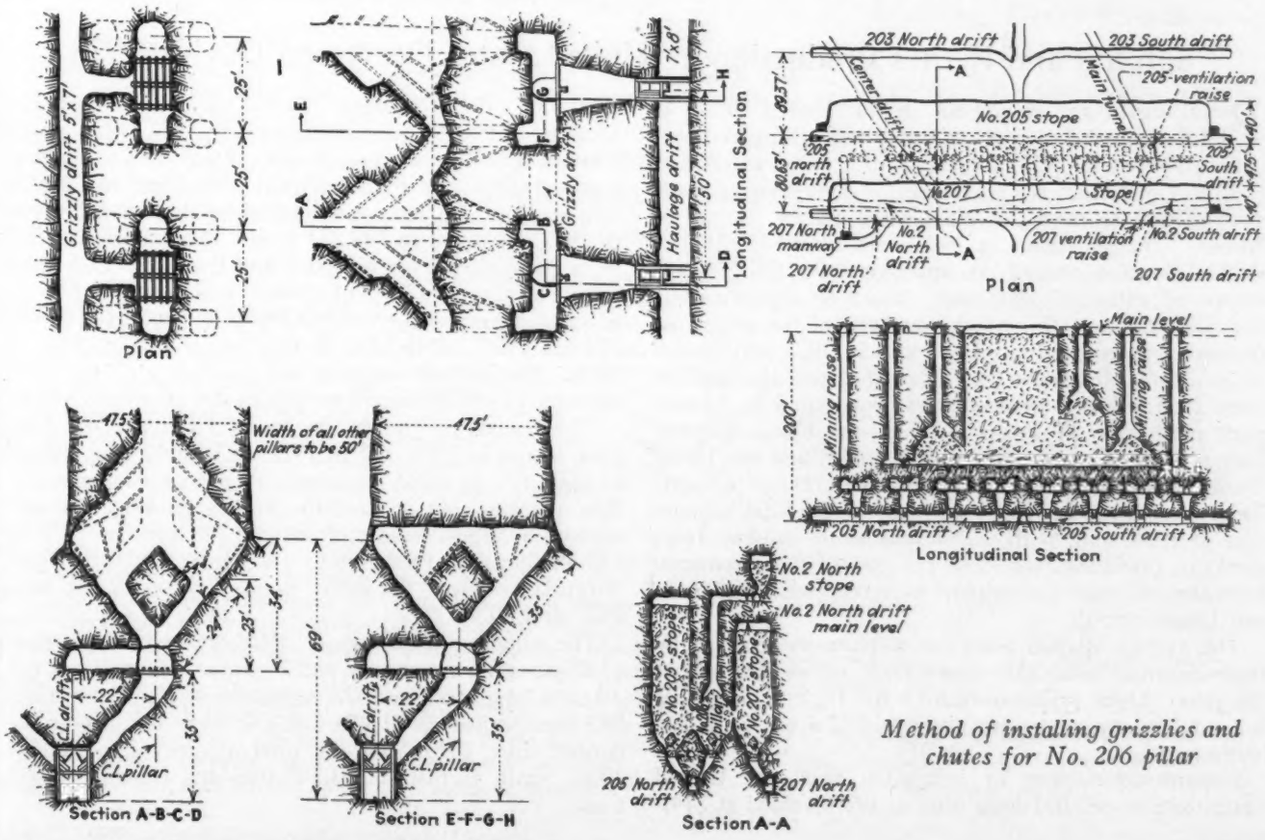
The standard stope equipment includes 3½-in. x 9-ft. double screw columns with 30-in. arms, with three 14-ft. bars on hand for special set-ups. These bars differ from a standard bar in that instead of a solid cap, a ball-and-socket joint is provided, and the top of the column is capped with rubber 1 in. thick. This makes unnecessary any blocking at the top of the bar and results in a saving of from 20 to 30 min. in making a set-up. The idea was worked out at Climax, and under the extreme condition of working an X-71 on the 14-ft. bar no trouble has been met.

All machines are supplied with air through 1-in. hose, with line oilers used for lubrication. The main air lines into and throughout the stopes are 2-in. hose instead of pipe, as it proved quicker and easier to remove prior to blasting, and also cheaper to install and maintain. Owing to the extremely hard nature of the rock, steel breakage with these large machines presented a very serious problem, but this difficulty has been overcome through the use of molybdenum drill steel, the toughness which molybdenum imparts to the steel adding materially to its life. The use of this steel has been standard practice now for the last eighteen months, entirely because of its ability to resist breakage.

Drawing of Ore Important After Caving Has Started

As the pillars are mined it is expected that the capping above the ore over the entire block will cave, so it is planned to start this caving from the major fault on the east of the block. The stope nearest the fault will be the first that is completed; after the second stope is finished the pillar between them will be taken, the shrinkage ore from all being left as close to the back as possible. The back will then settle on the broken ore, so that by careful control of the drawing, a high extraction without dilution should be obtained. This is the main purpose of carefully spacing the tops of all raises above the grizzly to 25-ft. centers. Further to insure proper settling and drawing, observation drifts are provided on the ends of the stope block on the upper horizon.

The chutes from which the ore is finally drawn on the haulage level are equipped with 30-in. arc gates operated by hand. To provide room for the chutes, 14 ft. of ground is cut out, which allows for an electrically lighted loading platform with ample headroom. The lips of the chutes are 6½ ft. above the rail. As the service on these chutes is not hard, because of their having grizzlies installed above them, 8 x 8-in. posts and 3-in. planking are used in their construction, the bottoms being lined with ¼-in. steel plate.



Method of installing grizzlies and chutes for No. 206 pillar

Haulage distance from the ore bins to the center of the ore block is 950 ft. Mining is all done on the day shift, followed by pulling of ore on the following two shifts, on account of limited bin capacity. Two trains of four cars each, handled with storage-battery locomotives, are capable of delivering 1,000 tons in two eight-hour shifts. The track gage is 24 in., with 30-lb. rails laid on 4 x 6-in. sawed ties, and with butt double-throw switches used at the cross drifts. The locomotives are 3½-ton Whitcombs, equipped with Edison storage batteries. A set of batteries fully charged normally lasts throughout the two shifts, but a spare reserve set is always charged and ready for service. The cars used are the Card rocker-dump, with a capacity of 4½ tons. They are equipped with roller bearings and are heavily reinforced on the outside with 30-lb. rails; on the inside, an extra thickness of ¼-in plate around the center of the car for half its length protects the body when the car is being loaded at the chutes. As the ore is dry, this type of car has proved very satisfactory and it eliminates spillage along the track; the gable-bottom cars formerly used have been discarded.

Method of Overcoming Frøzen Water in Ditches During Winter Operation

At present the mine is making between 75 and 100 gal. of water per minute. During the winter, when the temperature drops to 30 deg. below zero, water freezing in the ditch causes considerable trouble by overflowing the track and freezing again, resulting in serious interruption of traffic. To overcome this, a 6-in. pipe line is laid in the ditch, and in the top of this pipe is suspended by U-bolts a 2-in. steam line. Steam traps are connected into the steam line at 250-ft. intervals, and the whole pipe line is boxed in and insulated with sawdust. A 25-hp. boiler furnishes steam at 60 lb. pressure. This installation has effectively solved the problem of handling mine water during the cold period.

The steel shop is equipped with a No. 50-I.R. sharpener and an oil forge. Most of the steel coming into the shop is 1¼-in. hollow round, but some solid 1-in. quarter octagon, and some 1-in. hexagon, is also used. A modified Kerr Lake bit with a double taper of 5 and 14 deg. has been adopted as standard for Leyner steel. A ¾-in. dolly pin is used on steel up to 6 ft. long; from 6 to 12 ft. the dolly pin is ⅝ in.; and from 12 to 21 ft. a ⅜-in. pin is used. On account of the hard rock and long steel, two shifts are worked on the sharpener, so that between 900 and 1,000 steels are sharpened daily.

The compressor plant is made up of a battery of five Ingersoll-Rand two-stage compressors all in line, belt-connected and electrically driven. Three of these compressors have a capacity of 800 cu.ft. at sea level and two have a capacity of 600 cu.ft. These compressors have been added from time to time as increasing production has demanded, but the installation under present conditions is proving very efficient, in that one or more units can be thrown in or out as the load demands. Air pressure at the compressors is 90 to 95 lb., the air being conveyed to the center of the mining block in a 6-in. line, so that 80- to 85-lb. air is supplied to the drills.

In a concluding article, to be published soon, the crushing plant, cable tramway, and concentrating equipment and process will be described, together with some suggestions as to the use of molybdenum steel about a mining and metallurgical plant.

Sulphur and Pyrites Production in United States Decreased During 1928

PRODUCTION of sulphur in the United States in 1928 amounted to 1,981,873 long tons, compared with 2,111,618 tons in 1927, a decrease of 6 per cent, the Department of Commerce announces, in summarizing a statistical canvass made by the United States Bureau of Mines. The shipments in 1928 were record-breaking—2,082,924 tons, valued at approximately $37,500,000, compared with 2,072,109 tons, valued at approximately $38,300,000, in 1927. Stocks on hand at the mines decreased approximately 100,000 tons in 1928 and totaled about 2,000,000 tons at the end of the year, the smallest since 1921. Two new properties contributed to the sulphur production of Texas in 1928—the Union Sulphur Company at Wharton, Wharton County, and the Duval Texas Sulphur Company at Benavides, Duval County. Texas accounted for 99.88 per cent of the total production in 1928, and, with the shipments of sulphur from stocks in Louisiana, for 99.87 per cent of the shipments. Increased shipments of sulphur were reported for Nevada and Utah.

The average quoted price for sulphur, as reported by trade journals, was $18 a ton f.o.b. mines throughout the year. Open prices were $1 a ton higher and prices for sulphur exported were given as $22 a ton f.a.s. Atlantic ports.

Exports of sulphur or brimstone from the United States totaled 685,051 long tons in 1928, valued at $14,345,075. Of this amount, 159,664 tons was exported to Canada, 125,659 tons to Germany, 109,348 tons to France, 85,500 tons to Australia, 48,928 tons to Netherlands, 44,098 tons to the United Kingdom, and 22,801 tons to New Zealand. Exports of sulphur or brimstone in 1927 amounted to 789,274 tons. The exports in 1927 were the highest ever recorded and those for 1928 were second in size. Exports of refined, sublimed, and flowers of sulphur increased from 31,419,221 lb., valued at $544,373, in 1927, to 44,536,508 lb., valued at $706,766, in 1928. Imports of "sulphur and sulphur ore" for 1928 amounted to 3,938 long tons, practically all from Canada.

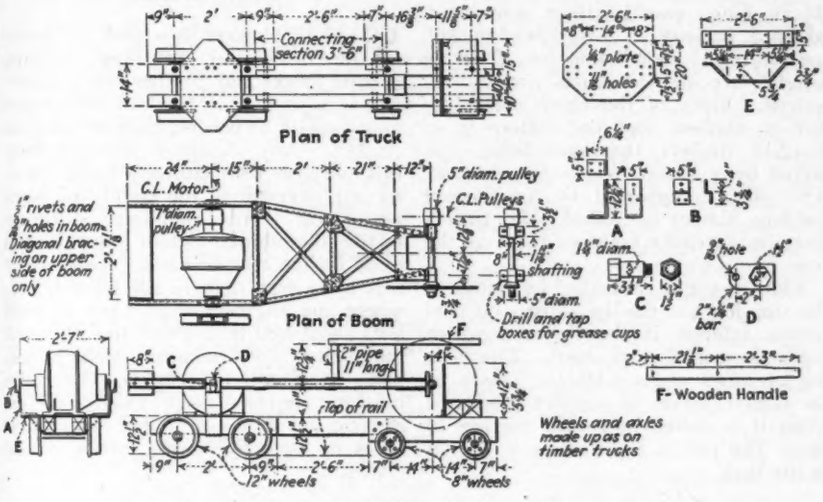
The output of pyrites decreased from 215,786 long tons, valued at $804,006, in 1927, to 182,049 tons, valued at $605,459, in 1928, or nearly 16 per cent in quantity. The quantity sold or used by producing companies also showed a large decrease, from 206,724 tons in 1927 to 179,484 tons in 1928, or 13 per cent. California and Virginia produced the entire tonnage recorded for both 1927 and 1928.

The imports of pyrites in 1928 showed an increase of 83 per cent in quantity and 76 per cent in value, from 250,794 long tons, in 1927, valued at $647,512, to 457,973 tons, valued at $1,139,436, and were the largest recorded since 1919. Of the total quantity imported in 1928, Spain furnished 393,840 tons and Canada 56,665 tons.

USEFUL OPERATING IDEAS

Portable Power Saw Useful Underground

THE portable cut-off saw shown in the accompanying drawing was designed and built by the Old Dominion Company, Globe, Ariz., for underground use, according to Charles Mendelsohn, mechanical superintendent. It can be moved around easily on the 18-in. gage track in the mine and is used for sawing up old timbers that accumulate at various places underground. The saw blade is 30 in. in diameter and is driven by a 5-hp. d.c. motor, power being taken from the trolley line. The motor is a Westinghouse Type S frame No. 3, 230 volts, 870 r.p.m.



Details of Old Dominion's portable underground saw

Special Building Materials in Coniaurum Mill

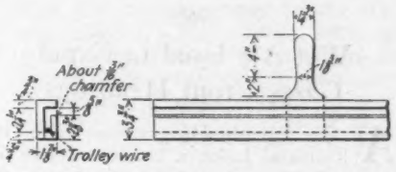
AN ATTRACTIVE PLANT of up-to-date construction has been erected at South Porcupine, Ontario, by the Coniaurum Gold Mines, Ltd., whose mill was recently placed in commission. The framework of the mill is of steel. It is inclosed with $\frac{7}{8}$-in. shiplap, over which, on the outside, is laid $\frac{1}{2}$-in. Celotex, which, according to the management, costs there about the same as lumber. Over the Celotex are laid asbestos-slate shingles. The office building has a timber frame, with 2x6-in. studs covered with $\frac{7}{8}$-in. shiplap, which in turn is covered with heavy felt paper and asbestos-slate shingles. On the inside of the studs "Gyprok" is used, forming the interior wall of the office. This, as its name implies, is a gypsum product similar to sheetrock. The space between the studs is filled with Insulex, which furnishes adequate insulation against cold, and is likewise soundproof as well as fireproof. All other buildings of the plant, including the shops and the dry, have a frame of 2x6-in. studs covered with $\frac{7}{8}$-in. shiplap, over which is laid the heavy felt paper and the asbestos-slate shingles. Mr. J. Reddington is the manager of the plant.

Compressed-Air Safety Whistle Reduces Accidents

FOLLOWING several motor-train accidents to workmen employed in crosscuts off the main-haulage drifts, a compressed-air safety whistle was designed and installed, writes H. S. Duncan, chief mine engineer, Old Dominion company. The whistle, constructed of $\frac{1}{4}$-in. wrought-iron pipe, and connected to the switch throw by means of a toggle arm and rod, is also connected to the compressed-air service line in such a manner that it automatically produces a shrill warning blast whenever the switch is thrown directing the motor train into the crosscut. Since installing the device no serious motor-train accidents have occurred to workmen in crosscuts.

Simple Trolley Guard Lessens Hazard Underground

THE ACCOMPANYING sketch shows an efficient trolley guard used by the mine department at Old Dominion, according to the company's mechanical superintendent. This guard is used where men are working under trolley wires that have no permanent protection. It is cheap to construct, it can be attached to the wire without a workman's hands coming near the wire, and is effective. It is made from a single piece of 2 in. x 4 in. x 5 in. lumber, dressed to $1\frac{7}{8}$ in. x $3\frac{3}{4}$ in. The handles of the guard are $\frac{3}{4}$ in. x $3\frac{1}{2}$ in. x 10 in., and placed at about 2 ft. $7\frac{1}{2}$ in. between centers.

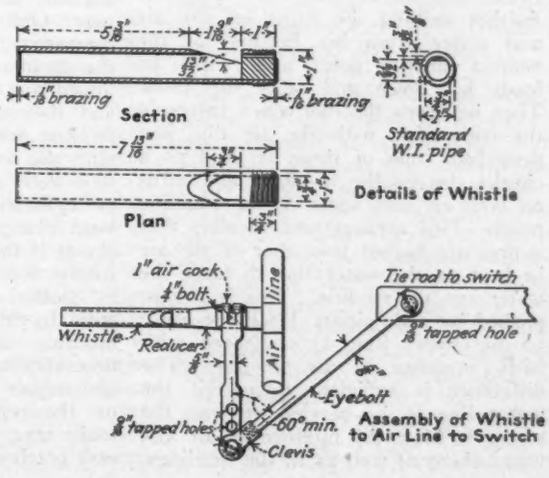


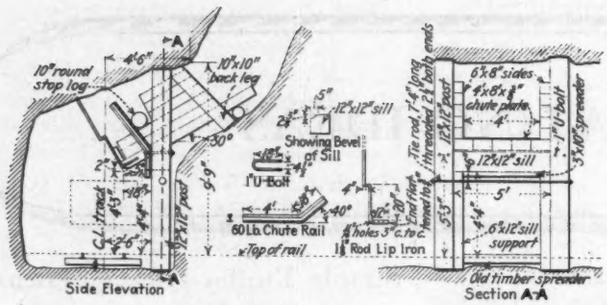
Guard for mine trolley wire

Welding Diary Useful as Record

In plants where considerable repair work is done by welding, it will prove interesting as well as instructive if the master mechanic will keep a record of the repair jobs handled. At one shop following this procedure, it is customary to put down the cost of labor and sup-

Details of switch-operated safety-air whistle





Details of the Horne standard chute

Material Required for Horne Chute

2 12x12-in. posts, about 11 ft. long
1 12x12-in. sill, 5 ft. long
2 10x10-in. back legs, about 5 ft. long
5 6x12-in., 9 ft. long, chute bottoms
4 6x8-in., 5 ft. 6 in. long, chute sides
6 6x8-in., 3 ft. long, chute sides
2 6x12-in. sill supports, about 5 ft. long
1 3x10-in. spreader, 4 ft. long
1 old timber spreader, 4 ft. long
1 round timber sill, about 7 ft. long
1 10-in. round stop log, 9 ft. long
1 3x10-in. chute board, 7 ft. long

Iron

2 60-lb. rails, as shown
2 1-in. U-bolts, as shown
2 1½-in. lip irons, as shown
1 1-in. tie rod, 7 ft. 4 in. long
1 4x8-ft.x⅜-in. chute plate
6 ⅝x10-in. lag screws
15 4½x4½-in. track spikes
50 ⅝x12-in. timber spikes

plies consumed in making the welding repair. Opposite this is set the cost of a new part. Such a record will show the amount the company has avoided spending by the use of welding. Of course, the full cost of a part is not saved, inasmuch as the repair does not double the life of the part.

Wet Air Used to Expel Gases From Headings

AT the Wright-Hargreaves mine, in Kirkland Lake, it is the practice of the machine men to blow a mixture of air and water instead of air alone, after blasting, to expel the smoke and gas. To make this possible the water line is connected to the air line near the heading, so that water may be mixed with the air as desired. The mixture is blown through a ⅛-in. hole in a cap placed over the end of the 2-in. air line. This cap is screwed on by the driller after he has spit his fuses and is about to leave the heading. Connection of water line to air line is made in the following manner: At a point some distance back from the heading a tee is inserted in the air line. Into this tee at 90 deg. to the line is screwed a nipple, on the end of which is an ordinary valve such as that used for regulating the water on the drilling machines. From this valve runs a 5-ft. length of water hose, terminating in another valve, which is connected to the water line running to the face. These two valves are kept closed except when it is desired to blow the mixture of air and water.

The procedure followed by the machine man is as follows: When he finishes drilling, he turns off the air and water from his heading at the nearest junction point, after which he loads his holes and spits the fuses. Then he opens the two water valves in the connection with the air line just described (one of these is used as a check), leaves the heading, and turns on both air and water at the junction point. This arrangement requires that a pressure higher than that of the air be kept on the water line to force the water into the air line. This is accomplished by maintaining 125-lb. pressure on the water line, as compared with 95-lb. pressure on the air line. The difference is sufficient to permit the water line to be carried up into the stopes to blow the mixture of air and water there as well as in the headings.

Horne Standard Chute Has Novel Lip Iron

THE chute adopted as standard at the Horne mine, at Noranda, Que., is shown in the accompanying illustration. Two 12x12-in. posts, about 11 ft. long; two 10x10-in. back legs, about 5 ft. long; a 5-ft. 12x12-in. sill, and a 10-in. round stop log, 9 ft. in length, are the principal timbers required. Sides of the chute consist of 6x8-in. timbers and the bottom is of 6x12-in. timbers, the latter being protected by a 4x8-ft. plate of ⅜-in. steel. The sill is supported by an upright 6x12-in. timber on either side, with a 3x10-in. spreader between them at the top.

Flow of ore is controlled by means of the stop log and the lip board. Of particular interest is the lip iron which holds the board in position. The 4-in. jog or offset at its midpoint, shown in the sketch, serves to support the board when it is raised to permit the ore to run. The end of the lip iron is driven in the back.

Keep the Hoist Man Comfortable

SMALL blowers intended to lessen the discomfort of men working around forges and in other warm localities in a shop have been on the market long enough to become familiar to most readers. Any means of accomplishing this purpose will naturally bring about an improvement in the quality of work performed. An employee suffering bodily discomfort cannot put his full mind on the task in hand. Nowhere is this more true than in the hoist house, where the engineer must have his full wits about him throughout the shift. At the plant of the Coniaurum Gold Mines, Ltd., at South Porcupine, Ont., the hoisting engineer is provided with an electric fan of the ordinary type which is set up close by, on the railing of the platform.

To Facilitate Repair of Stoper Rock Drills

THE stoper rock-drill repair table illustrated herewith was developed by the mine blacksmith foreman, John Williams, and has solved to a large extent the problem of quick and safe handling of these machines during repair, writes C. J. Rofelty, assistant chief mine engineer, Old Dominion company. To operate the head clamp is released and thrown open and the stoper machine is then laid horizontally with the foot end in the foot rest and the head or cylinder end in the head clamp. The head clamp is then closed and firmly set into position by means of the toggle bolt. In this position the machine is ready for necessary repairs. Tools and repair parts placed on the repair table or tool tray are within easy reach of repair man.

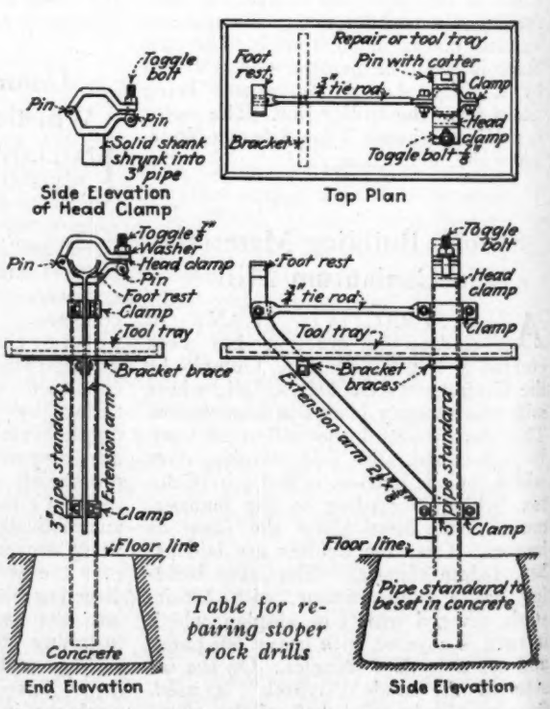


Table for repairing stoper rock drills

COMMENT AND CRITICISM

California Hydraulic Miners Ask for Legislation

To the Editor of "E.&M.J.":

Assembly bill No. 650, introduced by Jerrold L. Seawell at this session of the California Legislature, is an exact copy of the measure introduced two years ago by H. C. Cloudman, assemblyman from Alameda County, Calif. The Cloudman bill was defeated in the 1926-27 legislature by the scant margin of one vote in the Senate. Every opponent at that time gave as his reason the danger that the high concrete dams would fail, or that they would not effectively impound the débris. On the merit of these two objections the bill had to stand or fall.

At the present session of the legislature, with every member of both houses present, ratification of the building of the Boulder dam on the Colorado River was unanimously voted. Evidently members of the legislature have given much conscientious study to the effectiveness of high concrete dams during the past two years. The highest dam proposed by the hydraulic miners is at the Narrows on the Yuba River, above Marysville. The dam is to be 220 ft. high. Boulder dam will be 550 ft. high, or just two and one-half times the height of the proposed Narrows dam.

Senate document No. 142 states that investigations on the Colorado River prove that approximately 182,000,000 cu.yd. of silt is carried by that stream annually. On the Yuba River above the Narrows dam, the hydraulic miners propose to wash 117,000,000 cu.yd. over a period of twenty years, or one-thirtieth the amount of silt in the Colorado. Furthermore, 65 to 85 per cent of the hydraulic washings are coarse cobble stones and gravel that will never move far from the dump of the mine into the main stream. On the Colorado, silt is fine, and in no great time will collect behind the dam.

The flood plane of the Yuba River is 110,000 sec.-ft.; the Colorado, 384,000 sec.-ft., or three and one-half times as great. The Narrows dam will impound approximately 200,000 acre-ft. of water and the Boulder dam upward of 20,000,000 acre-ft., or over one hundred times as much water. In the comparison of these two dams—the smaller one voted down as a menace, the larger one voted for later as a protection—it would seem that the legislators of the state should have given the matter considerable serious thought.

The Boulder dam will provide employment for the poorest paid labor in America, and the Narrows dam for the highest. The one will bring more competition and the other will provide a larger market for American farm products and at the same time entail no economic competition in any way. Hydraulic mining behind the Narrows and other dams will tend to stabilize the labor market by providing labor with employment in the winter months and releasing it about the time farm work is at its peak. This is not an argument against the Boulder dam, but a statement of facts.

As to the efficiency of concrete dams holding back the débris from the hydraulic mines, attention is called to the Bullards Bar dam, on the North Yuba River. This dam is 175 ft. high and backs water 7 miles. It was built in 1920. Samples of the water coming over this dam indicate so little sediment in it that instruments delicate enough to measure the volume were not available. Eleven mines have permits to operate behind it.

Otto Von Geldern, engineer in the employ of the Sutter County protestants of hydraulic mining, admitted before the Commonwealth Club hearings on hydraulic mining that these dams could be built so as to be effective. The foregoing statements of fact would seem to effectually dispose of the two main arguments against hydraulic mining.

Some will ask, "Why do not other private owners build dams such as the Bullards Bar dam (a private enterprise)?" The builders of this dam have discovered what a number of old-time hydraulic miners already knew: that they would be storing all the débris from drift- and quartz-mining operations without recompense as well as all the natural erosion, which is probably greater than from all forms of mining. And, in the particular section where hydraulic mining can be carried on, natural erosion comes largely from Uncle Sam's land in the forest reserves and national parks and is augmented by logging and grazing operations from which said Uncle Sam collects large revenues and pays no local taxes thereon. Thus, in view of the fact that Uncle Sam sold the gravels to the hydraulic miner, who bought them in good faith with the implied right to work them by the hydraulic process, and that since 1893 the federal government has taken over the strict regulation of hydraulic mining, it seems as though it might be up to the governments, state and federal, to lend the miner a helping hand.

When driven from every other position, the opposition sets up the cry of paternalism. This comes with poor grace from the agriculturists of California. The farmer has his place in the governor's Council. The miner is denied this right. The farmers of California are allowed $1,849,792 in the budget before the present legislature; the State Mining Bureau $129,018, with an additional $20,000 for special work. Of the sum allowed the farmers, not one cent will be returned, while five times that allowed for the support of the State Mining Bureau will be returned. In addition to this, 40 counties in California employ farm advisors, 28 of these have one or more assistants, and 24 have home demonstration agents. Not a single county in California spends one single cent to aid or foster mining. Furthermore, all the hydraulic miner is asking is a loan to be repaid out of charges for storing his tailings behind these dams. The miner's problems should be the farmer's problems, for they constitute one of his nearest and most profitable markets. Every unbiased body of men or women that have heard both sides of this controversy have found for the hydraulic miner. Paul Bailey, state engineer, in his recent report on the water resources of California, recommends that from 5 to 10 per cent of the proposed water storage be set aside for hydraulic mining, where possible of use. Even in the Senate of the last legislature, where he lost by one vote, the hydraulic miner had a majority of those present.

The country needs the gold, and the hydraulic miner should, as a matter of right, be permitted to work or be reimbursed. The first steps must be taken by the state before federal aid will be forthcoming. No one will be injured, many will be benefited, so the time has come to put political ballyhoo and prejudice in the background and right a wrong of nearly half a century's standing. It might be well for the opposition to note the attitude of President-elect Herbert Hoover, a mining engineer, toward agriculture.

JAMES D. STEWART.

San Francisco, Calif.

Canada Pushes Ahead With Better Housing Plans

To the Editor of "E.&M.J.":

With further reference to the subject of the articles by Mr. Clement and myself in recent issues of *Engineering and Mining Journal:*

The Dominion Government is sponsoring a radio talk this month from its Health Department, giving information about the possibilities of cheaper, safer, and climatically more suitable construction in the rural and outlying parts of the Dominion.

The annual number of the *Pulp and Paper Magazine* is featuring a paper plant at Ashbridges' Bay, Toronto, where the construction of the walls of the building between the structural steel supports was of fireproof frame construction, treated very much the same as was the dormitory described, except that the outside was covered with Johns-Manville asbestos shingles, and the inside with ¾-in. thick gypsum Rocboard over a porous paper and galvanized wire mesh. This porous paper and wire mesh allowed the wet-poured Insulex to be dried out before the Rocboard was fixed on the interior of the studs to give the face of the latter fire protection.

A great many other industrial and community buildings are being developed somewhat similarly, so that you can see that evidence is accumulating to prove the wisdom of pioneering along these lines. JAMES GOVAN.

Paris, Ont.

Small Companies for Small Mines

To the Editor of "E.&M.J.":

The letter of W. R. Wade in the *Engineering and Mining Journal* for Jan. 26, 1929, interested me much, especially as it was to a letter of mine that he referred in the opening paragraph. I wish other engineers would publish their views about what, in their opinions, are desirable mines and what are undesirable ones. His condemnation of the mine about which I wrote is based on very slight evidence and perhaps is partly due to the habits of thought acquired by his company's desire to buy only large mines, especially developed ones. Large companies, I have been told, do not want small mines, because, if for no other reason, of the large expenses of the city offices and the traveling staff, which expenses are not a part of the actual expenses of operating the mine. Small mines are more apt to be successful if operated by a small company without large office and traveling expenses, and if managed by a resident superintendent who is accustomed to small-scale operations rather than to large-scale ones. There are small companies that take and operate small gold mines. How many are successful and how many are not is not recorded anywhere, and a man's opinion of the number of successful ones is naturally based largely on his own observation. Some of the failures are undoubtedly due, not to the mine itself, but to lack of capital and the other causes that aid in bringing failure to any business.

Should not the mining papers publish, in addition to technical articles, articles dealing with the business side of mining? Articles by different examining engineers telling on what evidence and calculations they accept or reject a mining property, and articles by operating engineers telling how they obtain profits from a mine? Mining is a business, and, to those who provide the capital for it, interesting only because of actual or possible profits; should not technical men, in addition to the technical knowledge and ability required to mine ore and extract its valuable contents, know how to mine and treat that ore so as to produce the most profit, and by producing profits make the business on which they are dependent attractive to capitalists? F. J. GIRARD.

Oakland, Calif.

Ore Reserves at Matahambre

To the Editor of "E.&M.J.":

The Sixtieth Annual Review and Statistical Number of the *Engineering and Mining Journal* contains on page 126 an article on Cuba, which states that the ore now developed in the Minas de Matahambre amounts to 125,000 tons. We presume this is a misprint. The ore blocked out on Jan. 1, 1929 (figuring only such ore as has been completely silled out on two levels and connected by raising), amounted to more than 900,000 tons. There was mined in 1928 a total of 369,021 short tons.

OTTO SUSSMAN, President,
Minas de Matahambre.

New York City.

A Word for El Dorado

To the Editor of "E.&M.J.":

Las Vegas, Nev., "The Gateway of Boulder Dam," is unique in the Western mountain region in that it is the center of investment excitement without any talk of mines or mining: the assembled speculators are unanimously real estate men. Their energy will, in time, exhaust the great opportunities, however, whereupon those knowing of the real riches below the surface in districts tributary to Las Vegas will make themselves heard.

To me, the gold, silver, zinc, lead, and copper occurrences in the El Dorado mining district, 35 miles south of Las Vegas and 20 miles below the Boulder dam site, afford a much better opportunity for permanent wealth than lots in real-estate subdivisions. The El Dorado district covers an area 6 miles wide extending 12 miles westward from the Colorado River. No extensive mining has been done there, though several million dollars was taken out of exposed veins before the main fracture extending through the district was recognized. The ore occurs in veins associated with an andesite porphyry dike. The main vein varies from 6 to 16 ft. in width, with parallel fissure veins usually from 30 in. to 6 ft. wide. Assays, of course, vary, but ore so far opened has yielded from $12 to $40 per ton.

Lack of interest by absentee owners of large patented areas has hindered development, but now the opportunity is open for new control.

G. A. DUNCAN.

Las Vegas, Nev.

Mining Industry Must Become Politically Minded

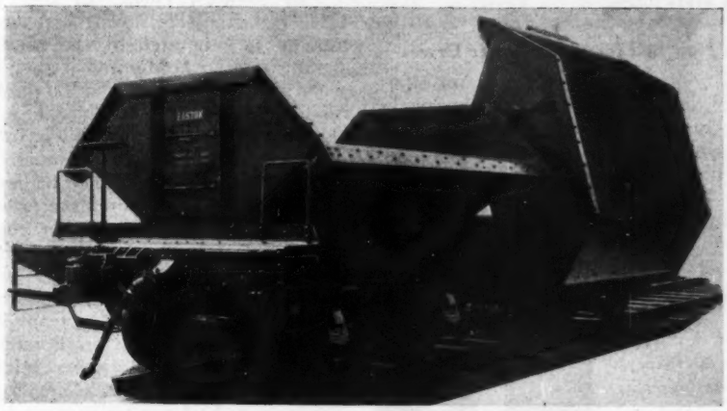
A correspondent who wishes to remain anonymous writes as follows:

"We will assume that over 90 per cent of our voters do not understand the mining industry or what it means to them; we will assume that only a small percentage of the members of Congress understand the importance of the said industry; we will assume that only a very small percentage of the men directly responsible for our military strength understand that that military strength is founded directly upon the mines of our country. You know the situation. The mining industry must get into politics with both feet—for its own sake and for the welfare of our country. The political situation is so static that unless we ourselves act it will take years to have our government back our industry; it will take years for that government to develop sectors like Alaska; it will take years for that gang even to adequately support our U.S.G.S. and Bureau of Mines. We must teach our defense department just where we stand regarding their programs. The mining press of our country understands that politics is an important part of the mining industry; but I note that the various corporations operating in this field pay very little attention to our political situation (relatively). We must devise a workable plan whereby members of Congress are educated in economic geology; we must even educate the voters as to the part the mineral industry plays in their daily economic lives. It is necessary that the men who control the franchise should fully understand what is behind our veil of prosperity."

READERS of "E.&M.J." are respectfully asked not to send in anonymous communications. Unless letters to the editor can be identified and their import, if there be any, made a matter of record, they will not be published. The writer's identity will be suppressed, if the request to do so be made, but the name and address of the correspondent must always be incorporated if he desires his comments to be read and published.

INDUSTRIAL PROGRESS

The Equipment Review



This standard-gage car has two 10-cu.yd. bodies, facilitating dumping

AMONG the equipment recently introduced which is of particular interest to the mining and metallurgical industries is the railroad car which is shown in one of the accompanying cuts. This car, which is manufactured by the Easton Car & Construction Company, Easton, Pa., was shipped to the Upper Peninsula of Michigan for handling iron ore in an open pit where the cars are loaded with an 80B Bucyrus shovel having a 2½-yd. dipper. The ore is hard and siliceous and weighs about two tons per cubic yard in place. Apparently, the largest pieces handled by the shovel and dropped into the car weigh approximately two tons. The car is known as the Duplex Phoenix type and consists of two 10-yd. bodies giving a total of 20 cu.yd., or 80,000 lb., capacity. It is designed for standard gage track and is equipped with A.R.A. designed trucks, automatic couplers of full size, with friction draft gear and Westinghouse air brakes. In all of the distinguishing features of its design it conforms strictly to A.R.A. practice and meets the U. S. Safety Appliance requirements.

The car is intended for work in any open-pit mine or quarry where power-shovel loading is employed. It is designed to dump at a fixed point, which in the particular installation referred to is the crusher bin. The dual unit permits the use of a short body, which is better adapted to discharging and placing the material on feeders. Dumping is effected by means of an arrangement either in the form of an electric or air-cylinder-type hoist. The arrangement is automatic and, when desirable, can be arranged for automatic remote control.

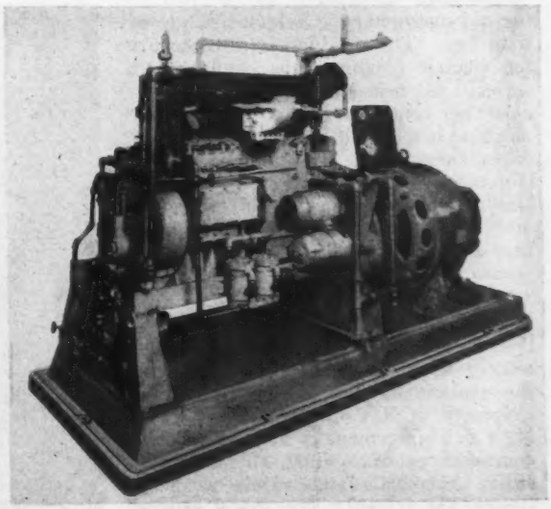
Compactness and Efficiency Feature Diesel Generator Set

The accompanying halftone depicts a special Buda M.A.N. Diesel-engine generator set recently built to order for use in San Francisco. Specifications called for "total variation in speed with unchanging conditions not to exceed 1½ per cent of the rated speed; the total variation in speed between no load and full load or between any intermediate load change not to exceed 5 per cent of the rated speed; time required for speed to recover to constant speed after any change in load between no load and full load not to exceed three seconds; with unchanging load conditions surging not to occur." These specifications indicate that the requirements were rigid.

In the installation described, the generator used is a 40-kw. 120-240 volt, 800 r.p.m. machine. A special over-speed safety stop was fitted to the fuel-injection pump. A fuel-oil tank, fuel-transfer pump, cooling-water regulator, and simple protective device were also supplied. Starting is effected by an electric mechanism operated with a magnetic-type switch on the control panel. In addition the control panel carries a lubricating-oil pressure gage, a thermometer for the cooling water, and a tachometer showing engine speed. The weight of the unit is 10,400 lb. complete.

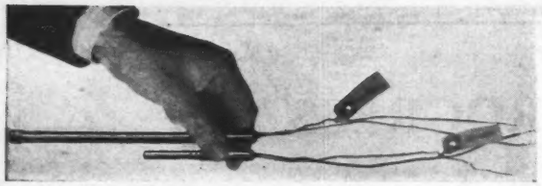
The Buda Company manufactures similar units for alternating or direct current, ranging from 40 to 100 kw. in d.c. units and from 50 to 125 kva. in a.c. units, the generator being constructed to the customer's orders.

A Diesel engine-generator set specially designed to meet rigid requirements



Two New Blasting Accessories

A new delay electric blasting cap has recently been introduced by the Atlas Powder Company, Wilmington, Del. The function of caps of this type is to provide sequence firing of charges in tunnel or shaft faces by a single application of electric current. If this were not possible, much time would be lost in phase loading and in the elimination of smoke and fumes after each blast; in fact, phase loading and firing would so increase the cost that most of the shaft sinking and tunneling of today could not be attempted and much less accomplished. For this reason the use of such caps has contributed to engineering progress. Up to the present time, however, the delays that have been used have not been entirely satisfactory from the consumer's standpoint, according to the manufacturer. They have been too thick and too long to be imbedded easily and completely in the ordinary dynamite cartridge of 1¼ x 8-in. dimensions. Ordinary fuse was employed as the delay element in their assembly, and this not only required the use of a thick rubber outer coating for protection



This new delay electric blasting cap is made in ten "delays"

against moisture but also had to be used in sufficient lengths to provide positive and safe firing periods.

The new cap is of rigid all-metal construction, and is an improvement over the old flexible type. Its length, moreover, is better proportioned to the length of a normal cartridge, which should remove the objection to the use of higher delays because of their lengths. Some contractors, the manufacturers state, have steadfastly refused to use delays higher than the fifth delay of the old type, because of the trouble encountered in imbedding them in a charge. The tenth delay of the new type is only 3¾ in. long, and therefore can be applied with about the same ease as a regular electric blasting cap. In other words, with the development of more delays, all of a convenient size, more precise work should be possible without the need of additional holes and without the need of as large charges as have formerly been used. These caps are equipped with a match-head firing device which permits the use of the so-called instantaneous electric blasting cap in the same circuit as the delays. This, in addition to the ten delays, provides eleven firing periods. It is expected that the use of these delays will obviate many of the difficulties caused by those of the old type, due either to their failure to function satisfactorily because of injury in the act of loading, on account of their length, or because of overlapping in firing.

What the manufacturers claim is the first machine of American design to apply the dynamo principle to a blasting machine sufficiently compact to slip into an ordinary coat pocket has been developed by the Hercules Powder Company, Wilmington, Del. This machine weighs only 4¾ lb. The dynamo principle, which is embodied in it, assures permanence of capacity in contrast to the old magneto type, which lost power with age. The machine is rated to fire ten electric blasting caps connected in series. All tests, however, have shown a 100 per cent power reserve. The new machine is a development of three years' experimentation. It is known as the Hercules ten-cap blasting machine. This size is expected to prove convenient for any kind of blasting where not more than ten shots are fired at once.

An Acid-proof Cement

U. S. standard acid-proof cement is the trade name of a new acid-proof cement which has just been placed on the market by the U. S. Stoneware Company, of 50 Church St., New York, N. Y. This cement is acid, alkali and corrosion proof against all acids, alkalies, chemicals and gases, weak or strong, hot or cold. The sole exception is hydrofluoric acid. The principal applications are for acid-proof tank linings, acid-proof floors, acid concentrators, acid-proof fan casings, galvanizing and plating tank construction, acid-proof stacks and linings for acid gases and fumes.

A New Belt for Short Center Drives

An endless V-type cog-belt for short-center drives was placed on the market recently by the Dayton Rubber Manufacturing Company, Dayton, Ohio. In designing this belt, the Dayton company has kept in mind the conditions met in service, and its construction embodies compression, neutral, and tension sections placed appropriately. As

This pocket-size blasting machine embodying the dynamo principle will fire ten shots

a result, it is claimed, the belt will run on small pulleys on short centers and will transmit any horsepower within its capacity, with minimum slip. A multiple-strand drive is illustrated.

Flexibility is secured by cog-like construction of the inner surface of the belt. This cogged surface is not for the transmission of power, but is used to secure flexibility and to prevent buckling when the belt is flexed around a pulley. The central or neutral zone, where compression and tension meet, is composed of a series of convolute layers of prestretched parallel cord fabric. These various layers are vulcanized while under tension, and hence are not subject to appreciable stretch while in service. The outer or tension section is constructed of layers of a bias-cut fabric, so arranged that it provides the proper amount of "give" without undue internal strain, when the belt is under load. The cog belt is built endless, and is afterward cut to shape. This construction brings the thread ends of the fabric against the pulley groove, providing a wear-resisting surface with a high co-officient of friction.

The greatest enemy of the V-type belt is excessive heat. A certain amount is generated by the continuous flexing and straightening of such a belt when in motion. This can be dissipated readily, but if to it is added heat from slippage and squashing down into the groove, so much heat is generated that the life of the V-belt may be lessened appreciably. The manufacturer claims that the construction of this cog belt eliminates entirely both squashing and slipping.

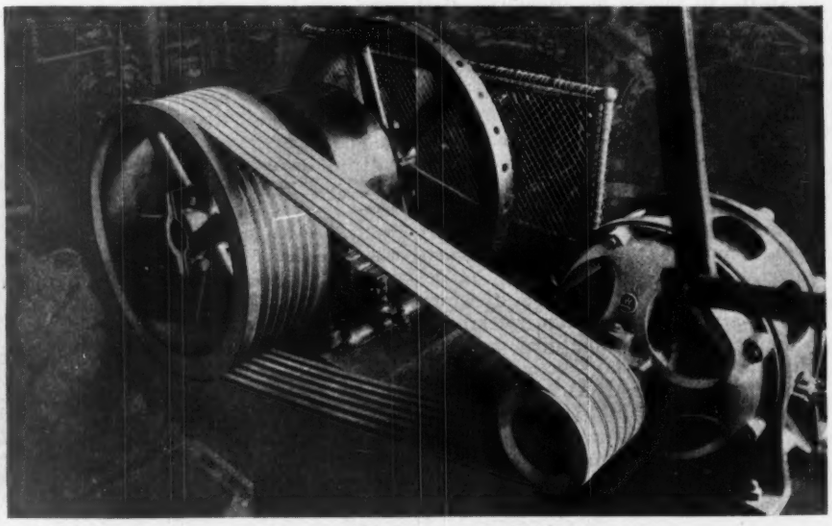
The minimum outside diameter of the motor pulley allowable is from 2½ in. to 15 in., depending on the horsepower, speed, and starting torque. Minimum center distance is usually equal to the diameter of the large pulley.

INDUSTRIAL NOTES

In the rehabilitation of the New Cornelia concentrator, at Ajo, Ariz., which is being increased 20 per cent in capacity, the flotation department will be completely remodeled. MacIntosh pneumatic flotation cells, manufactured by General Engineering Company, of Salt Lake City, will handle the entire output, which will be about 10,000 tons when the improvements now being made are completed.

R. A. Shilbauer, for several years assistant advertising manager of the Chain Belt Company, has been appointed advertising manager. The Chain Belt Company manufactures en-

A multiple-strand short-center drive employing a new endless V-type cog-belt



gineering and conveying equipment, chain, transmission, concrete mixers and pavers, which are marketed under the trade name "Rex." The company also operates a plant in Cleveland, Ohio, under the name of The Stearns Conveyor Company, where belt conveyors and bulk material storage systems are made.

The Timken Steel & Tube Company has put into effect an expansion program for the coming year that will necessitate expenditures of about $1,000,000. A tract of land 200 acres in extent has been purchased, which extends 2 miles west of the company's present holdings. This will provide room for future expansion of the plant facilities on the present basis of straight line production. Work has already been started on the first unit, a tube mill, which will be housed in a building 320 ft. wide by 420 ft. long. It is being erected at a cost of over half a million dollars for building and equipment. This mill will be completed and put into operation by April 1. Other extensions to the production facilities of the company will be made later.

Consolidation of six companies in the firebrick and refractories manufacturing and selling fields, owning fifteen plants in Pennsylvania, Ohio, Kentucky, and Missouri, into one organization known as the North American Refractories Company, was recently announced. The new company, organized in Delaware, will be the third largest of its kind in the United States. The units to be acquired by North American Refractories include Ashland Fire Brick Company, Ashland, Ky.; Crescent Refractories Company, Curwensville, Pa.; Dover Fire Brick Company, Cleveland, Ohio; Elk Fire Brick Company, St. Marys, Pa.; The Farber Fire Brick Company, Farber, Mo.; and Queens Run Refractories Company, Inc., Lock Haven, Pa. Capacity of the company's fifteen plants is estimated at 155,000,000 bricks per year.

To provide a single source of supply for all sizes of traveling cranes and electric hoists, the Shepard Electric Crane & Hoist Company, including its Sprague division, and the Niles Crane Corporation, combined under the title of Shepard-Niles Crane & Hoist Corporation. The Shepard plant, at Montour Falls, N. Y., and the Niles plant, at Philadelphia, Pa., will be continued in operation for the production of the types of equipment for which their respective facilities have been designed. The main office will be at Montour Falls, N. Y. The officers of the Shepard-Niles Crane & Hoist Corporation will be Colonel Edward A. Deeds, chairman of the board; S. G. H. Turner, chairman of the executive committee; Frank A. Hatch, president; Sydney Buckley, first vice-president; James A. Shepard, vice-president; and Robert T. Turner, vice-president.

The three divisions of the new corporation will operate as the Shepard division, the Niles division and the Sprague division.

PATENTS

DRILL. No. 1,700,241. Jan. 29, 1929. William Sengstaken, Brooklyn, N. Y.
Design for a drill bit.

MINE-CAR STOP. No. 1,701,040. Feb. 5, 1929. Seldon Jennings, Providence, Ky.
A design for an automatic mine-car stop.

VIBRATING SCREEN. No. 1,700,868. Feb. 5, 1929. Herbert S. Woodward, Carbondale, Pa.
A design for a vibrating screen.

DRILLING MECHANISM. No. 1,703,843. Feb. 26, 1929. E. G. Gartin, assignor to Sullivan Machinery Company, Chicago, Ill.
Design for a rock-drilling mechanism.

SAFETY LAMP. No. 1,702,048. Feb. 12, 1929. Harry S. George, assignor to Union Carbide & Carbon Research Laboratories, New York, N. Y.
Design for a flame safety lamp.

ANODE AND CATHODE FRAME. No. 1,700,178. Jan. 29, 1929. Joseph Porzel, Buffalo, N. Y.
A device for controlling electrolytic operations.

IDENTIFYING PRECIOUS STONES. Nos. 1,700,496-7. Jan. 29, 1929. Frank Heitzler, Boston, Mass.
Method and apparatus for identifying transparent precious stones.

MINE CAR. No. 1,699,535. Jan. 22, 1929. Warren V. Johnson and Robert C. Kepner, assignors to American Car & Foundry Company, New York, N. Y.
A design for a mine car.

REVOLVING GRIZZLY. No. 1,699,718. Jan. 22, 1929. Thomas Robins, assignor to Robins Conveying Belt Company, Passaic, N. J.
Design for a revolving grizzly consisting of a series of grooved rolls.

FORGING NICKEL. No. 1,700,460. Jan. 29, 1929. John H. White, assignor to Bell Telephone Laboratories, New York, N. Y.
Small amounts of vanadium and magnesium are added to molten nickel to render it forgeable.

SEALING FISSURES IN MINE WORKINGS. No. 1,700,952. Feb. 5, 1929. Leo Ranney, assignor to Standard Oil Development Company.
A method for forming a fluid-tight seal between fissures and mine workings.

PURIFICATION OF LEACHING SOLUTIONS. No. 1,703,435. Feb. 26, 1929. A. E. Wheeler, Scarsdale, N. Y.
A process for purifying leaching solutions that involves the introduction of ore particles and the removal of precipitated impurities.

MINERAL DRYING PROCESS. No. 17,212. Feb. 12, 1929. Reissue. McKinley Stockton, assignor to The Celite Company, Los Angeles, Calif.
A process for collecting disintegrated minerals, and for preventing dust losses of the same.

REVERBERATORY SMELTING OF ORES. No. 1,700,515. Jan. 29, 1929. George W. Prince, assignor to United Verde Extension Mining Company, New York, N. Y.
A method for smelting ores in reverberatory furnaces. Ore is deposited on the bottom of the furnace from overhead points, and fettling material is then blown from the firing end wall into the spaces between the side walls of the furnace and the ore previously deposited on the bottom of the furnace from the overhead feed points.

HYDROMETALLURGICAL EXTRACTION PROCESS. No. 1,703,763. Feb. 26, 1929. F. Diettsch, Kingston-on-Thames, England.
Oxide ores of lead or copper are treated with sulphur dioxide in the presence of water and the products of the reaction treated with an aqueous solution of a thiosulphate.

SHALE TREATMENT PROCESS. No. 1,703,192. Feb. 26, 1929. W. H. Hampton, Portland, Ore.
Extraction is effected by recovering volatilized products formed by heating solid bituminiferous minerals with an ammonia-liberating base and a mineral oil at temperatures not substantially exceeding 700 deg. F.

SMELTING MANGANESE. No. 1,703,657. Feb. 26, 1929. A. G. Betts, Kinderhook, N. Y.
Material containing manganese and silica is smelted with a sulphide, other than of manganese, and a fused manganese sulphide, metallic iron, and fused slag produced. The manganese sulphide is converted to manganese oxide which is reduced to metallic manganese.

MANUFACTURE OF SODIUM XANTHATE. No. 1,701,264. Feb. 5, 1929. Wilhelm Hirschkind, assignor to Great Western Electro-Chemical Company.
In this process normally-soluble xanthate is obtained as a precipitate from the reaction of an alcohol, caustic soda, and carbon disulphide. Caustic potash is then added to the mother liquor causing a further quantity of normally-soluble xanthate to precipitate.

RECOVERING CYANIDE. No. 1,701,818. Feb. 12, 1929. Louis D. Mills and Thomas B. Crowe, assignors to The Merrill Company, San Francisco, Calif.
A process for recovering cyanide from solutions. Solutions are first acidified, and recovery is effected by means of a separate flow of alkaline solution and a flow of air passing in closed circuit, first through the acidified solution and then through the alkaline solution.

Rock Drills

No. 1,700,378. Jan. 29, 1929. Arthur H. Skaer, Theodore E. Barker, Augustus H. Katterjohn and Omar E. Clark, assignors to Gardner-Denver Company, Quincy, Ill.

No. 1,700,380. Jan. 29, 1929. Arthur H. Skaer, assignor to Gardner-Denver Company, Quincy, Ill.

No. 1,700,418. Jan. 29, 1929. Ernest Penberthy, assignor to Chicago Pneumatic Tool Company, New York, N. Y.
Designs for rock drills.

BULLETINS

FIRE FIGHTING EQUIPMENT—Wirt & Knox Manufacturing Company, York St., and Sedgley Ave., Philadelphia. Catalog A-28. Sixty-four pages.

ROCK DRILLS—Sullivan Machinery Company, 122 South Michigan Ave., Chicago. Bulletin No. 81-V. "K-2" Buster for breaking concrete. Eight pages.

GAS PUMPS—P. H. & F. M. Roots Company, Connersville, Ind. Bulletin No. 33-B1. High pressure type rotary gas pumps. Sixteen pages.

SWITCHES—Monitor Controller Company, Baltimore, Md. Bulletin No. 113. AC. automatic starters. Eight pages. Illustrated.

Digest of Current Literature

Lodestone Magnetite. "The Identity and Genesis of Lodestone Magnetite." W. H. Newhouse, *Economic Geology.* January-February. Pp. 62-67. Lodestone is magnetite which possesses polarity like an ordinary magnet. Mineralogists have used the term only for magnetite in which the strength of polarity is marked, according to Mr. Newhouse, but all gradations appear to exist between ordinary magnetite with little or no polarity and that in which a fragment will pick up large iron nails. Only a small percentage of the magnetite known in the world possesses the requisite degree of polarity. Mr. Newhouse believes that the magnetite that becomes strongly polar and forms lodestone is chiefly ferromagnetic ferric oxide, or oxidized magnetite, which has a remanence about three times that of ordinary magnetite. Remanence is the tendency to retain a polar state.

"Two features would seem to be necessary for the formation of lodestone," says Mr. Newhouse, in summarizing. "First, a magnetite with remanence, and, second, a magnetite field to produce polarity in it." As to the first, the field evidence points to oxidation as being one of the causal factors in the formation of lodestone—that is, to oxidized magnetite. As to the second, the writer says the evidence is not clear as to the means of producing polarity. He cites evidence which suggests that the concentration of the earth's field at the ends of an orebody (where it is usually strongest) is sufficient to induce polarity. Lundberg, he says, states that lodestone is commonly found in Sweden and Finland at the northern end of the orebodies. Polarity may possibly be induced also occasionally by a concentration of the earth's magnetic field at points within the magnetite orebodies, owing to irregularities of mineralization or brought about by faulting.

Molybdenum. H. Alterthum. *Zeitsschrift für Angewandte Chemie,* Jan. 5. Pp. 2-11. The reopening of the Climax mine, in Colorado, in 1924, started a downward movement which has brought the price of Mo metal to a level that permits practical uses. Climax ore, being too lean for concentration by ordinary flotation, is first roasted and leached with soda. The Mo is then either precipitated as Ca molybdate, or converted back to the sulphide and further concentrated by flotation, for which paraffin and soda may be used instead of oil with the water. Other metals, such as Cu and Bi, can be separated during the flotation by passing in chlorine. Another way of removing Cu is to spray the concentrate with compressed water and effect the separation on a high speed vibratory screen. Electrolytic refining is suitable when the ore is roasted only enough to form a mixture of the lower oxides—that is, when the oxidation is not carried all the way to MoO_3. The latest method for making Mo metal is by reduction with Ca; the oxide is mixed with an excess of Ca turnings in a brass-capped iron tube, well evacuated, in a Perrot furnace. Reduction with Zn dust instead of Ca gives colloidal Mo. Uses of Mo are reviewed in some detail under the headings: ferro-molybdenum, electrotechnics, analytical reagents, catalyst, chemically resistant alloys, and molybdenum steel. Potential and actual users of Mo have been active investigators in this field. By extending the range of applications of the metal, their researches have helped in bringing down the price.

Ore Deposition. "Structural Control of Ore Deposition." Carlton D. Hulin. *Economic Geology.* January-February. Pp. 15-49. Mr. Hulin deals primarily with the "shoots of ascending circulation" or, as he explains, with primary oreshoots of epigentic deposits which have formed through the action of solutions or emanations. Replacement shoots he does not directly consider. Few of the present theories of oreshoot control have general applicability, he says.

In discussing the mechanics of oreshoot formation, Mr. Hulin says that although it does not appear feasible to predict, in advance of actual exploration, whether a given favorable position on a vein has or has not been affected by the requisite fault movements at a time contemporaneous with the metallization, nevertheless it is often feasible to predict positions along a vein where favorable structure may occur. He thereupon proceeds to name those vein structures which he considers favorable for the development of oreshoots if acted upon by fault movements at the proper time during the period of metallization. He emphasizes that they are effective only when acted upon repeatedly by slight fault movements during the time of metallization. They are: (1) Variation in strike of veins; (2) variation in dip; (3) intersections of veins and crossfaults; (4) vein intersections; (5) simple shear along vein; (6) torsion structures; (7) saddle, trough and leg reefs; and (8) mineral pipes. Mr. Hulin mentions certain other miscellaneous minor types of structure that may be favorable for ore deposition, among them unfilled vein centers.

Cobalt. *Chemical Age,* Jan. 5, Metallurgical Section, pp. 1-2. Current practice in the wet extraction of cobalt from low-grade ores is described. The ore (after roasting, if a sulphide ore) is ground, mixed with rock salt, roasted to form the soluble chloride, and discharged while hot into leaching tanks. It is then leached with a mixture of dilute hydrochoric and sulphuric acids. Iron remains in the residue; calcium is precipitated as sulphate; nickel and copper are acted on in the same way as the cobalt. The liquor is siphoned into another tank, where copper and lead are precipitated as sulphides. Then the liquor is siphoned off, neutralized and treated with excess sodium sulphide and leached with dilute acid to remove any iron sulphide. The mixture of cobalt and nickel sulphides is roasted to form sulphates, and the separation of the nickel and cobalt sulphates is preferably effected by adding ammonium bisulphate to form an insoluble double salt with the nickel sulphate. The cobalt sulphate is then converted back to the sulphide for working up into compounds or cobalt metal. No dry process has yet been applied successfully to the recovery of cobalt from poor ores.

Salt and Ore Deposits. H. Hunkel, E. Kohl, and R. Krahmann. *Metall und Erz.* November, No. 2. Pp. 571-82. Kohl has measured the magnetic profile between Salzgitter Ridge and Oderwaldsattel, and in comparison with the geologic profile has attributed positive or magnetic effects to the various rock strata. Some principles of interpretation of magnetic measurements—namely, for locating salt domes and other deposits—are discussed.

Tin in Bolivia. H. Goldmann. *Metall und Erz.* January, No. 1. Pp. 1-4 Bolivia, holding second place among world tin producers, has made considerable advances in modernization of the methods used for mining and metallurgy of tin. This is particularly true in the Patiño mines, where machinery has replaced hand labor. English and German establishments have been active in effecting improvements, and their yield has increased accordingly. A major advance has been in the introduction of leaching methods, whereby low-grade ores can now be profitably worked. Methods in English and German practice are described and compared.

Precious Metals. Robert Hesse. *Metall und Erz.* November, No. 2. Pp. 582-5. The platinum deposits of West Abyssinia are not so generally known as the gold. A French and an Abyssinian company are now mining platinum in the valley of the Birbir River, and a third company is being formed. The recent lifting of the ban on foreigners in Beni-Schangul Land has opened this region for exploitation, where according to present knowledge gold is much more abundant than platinum. Native methods of recovering alluvial gold are crude but fairly effective. Some modern improvements are suggested.

Sinking Shafts. Diehl. *Braunkohle.* Dec. 22. Pp. 1141-7. Dec. 29. Pp. 1165-71. The Zänsler method for sinking shafts for mines is described and illustrated, in part with reproductions from photographs from a Zänsler shaft constructed by the Berlin City Electric Company, at Lawitz. The system involves the sinking of a number of minor (auxiliary) shafts. Details of drilling and interior construction are described. The Sonnenschein cementation process is used. Pros and cons of further development and application of the Zänsler shaft system are stated and considered.

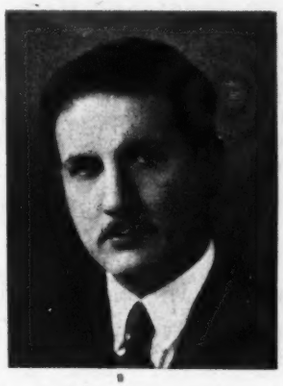
Utah Minerals. E. V. Shannon. *No. 2758—From the Proceedings of the U. S. National Museum.* Vol. 74, Art. 13, pp. 1-12. In this paper the author, who is assistant curator of geology of the U. S. National Museum, describes a group of more or less rare mineral specimens from southern Utah that were forwarded to the Museum during the summer of 1927 for identification. The minerals described are: tschermigite, the rare ammonia alum; ammoniojarosite, a new member of the jarosite group in which ammonium oxide replaces the potash of jarosite; epsomite; celestite; and a mountain cork, or paligorskite.

Personal Notes

Lewis E. Ashbaugh, mining engineer, has returned to Denver after a trip to Arizona and Mexico.

W. H. Clark, of Calumet, Mich., has been elected a director of Oneco Copper Mining to succeed the late John D. Cuddihy.

Professor **A. M. Gaudin,** at present a member of the faculty of the University of Utah, has been appointed research professor of ore dressing at the Montana State School of Mines, effective July 1, according to a recent announcement by Dr. F. A. Thomson, president of the school. His appointment marks the first research professorship to be established at the Montana institution and is in line with a policy of making Montana State School of Mines an outstanding mineral research institution. Although comparatively young, Professor Gaudin has already won national recognition in the field of flotation research. He received his preliminary education at the Lycées of Versailles and of Toulon, France, and his baccalaureate degrees from the Universities of Paris and of Aix. Subsequently, he was a graduate student at Columbia University, where he received his engineer's degree. Prior to his engagement with the University of Utah, he was for two years lecturer in ore dressing at Columbia, and was also associated with Taggart and Yerxa, consulting engineers, of New Haven, Conn., as research engineer. Numerous contributions on flotation, crushing, and classification have been made by Professor Gaudin to the technical press.



A. M. GAUDIN

Dr. **George A. Bridge** has resigned as chief surgeon of the Copper Queen hospital, at Bisbee, Ariz., and will move to Phoenix.

Thomas Ventre, of Patiño Mines & Enterprises, sailed for the company's properties in Bolivia from New York on Feb. 28, on board the "Santa Elisa."

John G. Tebbutt, of Three Rivers, Que., has been elected president of the Kirkland Premier, Ltd., in succession to **W. F. Empey,** who resigned on account of ill health.

D. F. Young, western manager of American Manganese Steel, left San Francisco on March 9, 1929, on a business trip to the Federated Malay States and the Orient.

Harrison E. Clement has been appointed president and managing director of Anglo-London Mining Corporation, with offices at 1603 Royal Bank Building, Toronto, Ont.

L. O. Howard, of Pullman, Wash., formerly dean of the Washington State College School of Mines, is now teaching metallurgy at the University of Idaho School of Mines, Moscow, Idaho.

Captain **James G. Ross,** has been appointed consulting engineer, and **K. M. Dewar** resident engineer, of the Chibougamau Prospectors, Ltd., operating in the Chibougamau mining area of Quebec.

R. V. Ageton, formerly accident prevention engineer for the Tri-State Zinc and Lead Ore Producers' Association, who has been in New York on business, has returned to his headquarters at Miami, Okla.

H. E. Skougor, consulting engineer for Guggenheim Brothers; **M. A. Kendall,** chief engineer of the Stephens-Adamson Manufacturing Company; and **J. C. Vidmar** have been visting Arizona mining districts.

F. W. Bradley, president of the A.I.M.E., will be the principal speaker at the annual banquet of the Northwest Mining Association to be held on March 11 at the Davenport Hotel, in Spokane, Wash. **Rufus R. Wilson,** of Seattle, will also speak.

C. W. Nicholson, mining engineer, formerly of Ishpeming, Mich., who supervised development of the properties recently taken over by the Canam Metals Company, Ltd., in the Tri-State district, has taken complete charge for the new owners.

Harrison Souder, formerly general superintendent of the Cornwall Ore Bank Company and general manager of Bethlehem Mines Corporation, Cornwall division, has opened an office as consulting engineer at 40 Wall St., New York City.

Hilliard W. Power, vice-president and field representative of the Northwest Mines Investment Company, has resigned to become secretary-treasurer of the Amalgamated Red Metals Company, which is developing a property in Valley County, Idaho. **C. E. Fulton,** formerly manager of the Unity Gold Mines, is managing director of the new company.

Major **Chauncey L. Berrien,** general superintendent of mines for Anaconda Copper Mining, at Butte, recently delivered an address at the Montana State School of Mines on "Mine Operating Supervision and Records." This address was part of an extension course being offered to the students and public by the school.

W. V. Butler sailed from New York for Belgium on March 2 on the "Pennland." Mr. Butler will be engaged in exploration work in the northeastern part of the Belgian Congo for the next two years. He will be associated with the Société Forestière et Minière du Congo. Mr. Butler can be reached by sending mail to Forminière, 42 Rue Royale, Brussels, Belgium.

W. V. BUTLER

OBITUARY

G. L. Duer, Denver mining engineer, and district supervisor of mineral and coal-leasing operations in Colorado, Wyoming, and New Mexico, for the U. S. Geological Survey, died at Denver on Feb. 22. Mr. Duer had occupied his position as district supervisor since 1923. He was 52 years old.

F. C. Jackson, mining engineer, of Montreal, died on Feb. 22, after a short illness, at the age of 49. He was a graduate of Toronto University, and served as major overseas during the war, receiving the Military Cross for his services. Mr. Jackson, was a director of Amity Copper and president of the Jackson Construction Company.

George C. Riser, concentrator superintendent for Nevada Consolidated Copper, died on Feb. 25 at his home in McGill, Nev., of pneumonia, at the age of 53. Mr. Riser was educated in Salt Lake City schools and received a bachelor of arts degree from the University of Utah. First an employee of the Utah Copper, he joined Nevada Consolidated Copper fifteen years ago. Mr. Riser was buried in Salt Lake City.

Myron C. Atwood, president and general manager of the Western Wheeled Scraper Company, died in Aurora, Ill., Feb. 26, 1929. Captain Charles H. Smith, founder and then president of the Western Wheeled Scraper Company, made him assistant manager in 1906. Upon the death of Captain Smith in 1910, Mr. Atwood was promoted to the position of general manager. In 1925, upon the death of Judge W. I. Babb, who had succeeded Captain Smith as president, he became both president and general manager.

NEWS OF THE WEEK

Summary

LACK of funds delays printing of U. S. Bureau of Mines reports, according to Scott Turner, Director of the Bureau, who answered questions on the subject before the Senate Mines and Mining Committee recently. Page 412.

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The new smelter stack at the Nevada Consolidated plant, at McGill, Nev., has been completed. It is 350 ft. high. Construction of the Cottrell plant is being started immediately. Page 411.

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The British government is considering co-ordination of the radium resources of the Empire to break the Belgian monopoly of the metal. Deposits in Cape Province, South Africa, are being investigated. Page 414.

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Two more mining engineers, one American and one British, have been kidnapped by Mexican bandits. The revolution now in progress has not affected mine production as yet. Page 413.

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Right to examine the accounts of American Smelting & Refining has been granted Carson Investment, in the effort to bring about a settlement for patent infringement. Page 411.

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Sherritt-Gordon will sink a new shaft at the western end of its properties in northern Manitoba. This will give the company three operating shafts. Page 413.

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Three old properties in the Organ Mountain district, New Mexico, have reopened and are shipping ore to the El Paso smelter. Page 411.

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Whitworth Finance & Mining has acquired the Paukwab Tin mine, in South West Africa, and is formulating plans for production of 300 tons of tin ore daily. Page 411.

Canadian Budget Includes Several Items of Importance to Dominion's Mines

Reduced Rates Proposed on Mining Machinery—Government May Get Permission to Place Duty on Imported Copper Rods—"Penny" Stock Taxation Increased

THE Canadian Minister of Finance has presented his 1929 budget in the House. As usual, it is viewed with the greatest interest by all industries throughout Canada, because it presents the proposed tariff changes. The present budget shows a substantial surplus, which permits tax reductions. The sales tax has been reduced from 3 to 2 per cent, and this of course affects all industries. Several reductions have been made which favor mining as one of the great basic industries of the country, and some anomalies have also been removed from the tariff which are beneficial to mining. Under the tariff certain mine and mill equipment and machinery was placed on a reduced rate of duty, but the act as interpreted by the Customs Department did not allow quarries to import machinery at this reduced rate, as quarries were not considered to be mines. In the 1929 budget this anomaly has been removed, and mines and quarries are now placed on an equal footing.

Flotation cells have been included in the list of concentrating machinery which may be imported at the reduced rate and electrically operated rotary coal drills are put on the free list as well as miners' acetylene and safety lamps, miners' "hard-boiled" hats, and distributing equipment for stone dusting in coal mines. The duty on a number of other items of coal-mining machinery has been substantially reduced.

Consideration has been given to copper-wire manufacturers by giving the government permission to place an import duty on copper rods when imported by manufacturers for use in their own factories in the manufacture of electrical conductors. This duty will be imposed when the government is satisfied that copper bars are being sold in the country of export for domestic consumption at a lower price than for export to Canada. This item arises from the fact that the export price for copper is higher than the domestic price in the United States, which gives American producers an advantage over Canadian firms. At present no copper is being refined in Canada, but this condition will be changed when Noranda and Consolidated Mining & Smelting have their new refineries in operation.

Mining brokers are greatly exercised over the changes made in the taxation on share transfers. Up to this time the tax has been 3 per cent ad valorem. The new budget proposes to make this specific and on a graduated scale, the new rates being regardless of par value and based only on the sales price of the stock. On shares selling for $3 or less the tax is 1c. per share; from $3 to $20, 2c. a share; from $20 to $100, 3c. per share, and over $100, 4c. per share. If this item goes through as proposed it will be a very serious blow to the penny stocks, because on stocks selling at 10c. a share the tax would amount to 10 per cent of the total value. There are a very large number of low-priced mining stocks, particularly of the development companies, and the new tax will fall heavily on these. The department expects not only to secure more revenue but also to discourage speculation in the cheap stocks. On some of these, however, the tax will be so heavy that it will probably be necessary to make a change in the final draft of the budget.

Seneca Is Increasing Labor Force for Development Work

PRELIMINARY work has been completed at Seneca, in the Michigan district, and more men are being taken on for development, which will be vigorously pushed. Emphasis will be placed on opening work. Sinking will be resumed in No. 1 shaft as soon as the miners are available. In the No. 8 and No. 9 levels, the openings to the south, in the direction of Ahmeek, are in good copper ground. This is an important development, for as the shaft gets deeper each new level will be approximately 200 ft. longer than the one above. The distance from the shaft to the boundary in the No. 9 level is 700 ft., but in the No. 10 this will be lengthened to 900. The No. 3 level drift from No. 1 shaft is being pushed northward beyond No. 2. Flotation will be adopted for concentration. Equipment for installation in the little Tamarack mill already has been authorized by Lake Milling, Smelting & Refining.

Anaconda Again Increases Wages at Montana Mines

IN KEEPING with its action when the copper price passed the 15c. and 17c. levels, Anaconda Copper Mining has announced another wage increase of 25c. a shift at its Montana properties, effective March 6 and as long thereafter as the copper price remains above 19c. a pound. This increase makes the present pay of miners in Butte $5.75 a shift, which is as high as they have ever been. Only during the war, when copper sold at 27c. a pound, were wages as high. This wage represents an increase of $1 over that obtaining before the recent increase in the price of copper began, in September, and of 50c. over the wage scale in effect only a month ago. About 18,000 mine, mill, and smelter men at the Anaconda properties are affected by this increase. Miners' contract prices have been adjusted proportionately.

No announcement has as yet been made by other of the large copper producers, but these will undoubtedly follow within a few days.

Three Properties in Organ District Now Shipping

THREE old properties in the Organ Mountain district, Dona Ana County, N. M., 15 miles northeast of Las Vegas, N. M., are being reopened, and ore is being shipped to the American Smelting & Refining smelter at El Paso, Tex. This region was first mined in 1849, and one of the properties has been operated almost continuously since that date.

The Stephenson Bennett property of American Smelting & Refining is being operated under lease, and a few carloads of silver-lead ore have been shipped. This property has been worked to the 500 level, but exploration in the lower levels has not been extensive. Molybdenum occurs with the lead, and the last few shipments have averaged about 3 per cent Mo.

The Torpedo property, north of the Stephenson Bennett, last worked by Phelps Dodge about the time the World War started, has been developed by an additional 200-ft. shaft, sunk in the south end, in the granitic formation. A crosscut has been driven to the contact zone, where some mill-grade copper ore has been developed. The contact zone carries the orebodies in this property, while at the Stephenson Bennett, lead-silver ore occurs near dikes in the limestone formation. The Radiore Company, of Los Angeles, recently made a reconnaissance survey of the north end of the Torpedo property, which showed indications of ore east of the contact zone and along the San Augustin fault.

The Memphis Corporation has also been developing its property, which is north of the Torpedo, along the contact zone. A shipment of copper-silver ore was made from the north end of the Memphis claim last week. The contact zone has been cut by a shaft, sunk more than ten years ago by Phelps Dodge, but no development work has been undertaken from this shaft. Ore has been shipped by lessees from the contact zone at the north and south ends of the claim, but most of the mining has been done along a fissure in the limestone formation, several hundred feet west of the contact of the limestone and the monzonite intrusive. Shaft repairing and deep hole prospecting with Gardner-Denver deep-hole equipment are under way at shaft "A."

New Mine Tax Bill Proposed in Arizona

A BILL has been introduced in the House of Representatives of the Arizona State Legislature which provides for an occupational tax of 6 per cent of the total value of the annual production of all mines in the state. In 1928, Arizona mine production was estimated at about $120,000,000.

Carson Wins Attempt to Examine A. S. & R. Accounts

AT TACOMA, WASH., on Feb. 26, 1929, the Carson Investment Company succeeded in its efforts to have the account books of American Smelting & Refining produced in the settlement proceedings now before Judge O. G. Ellis. Judge Ellis ruled that the account books for 1907-08 be produced. It is expected that through the cost accounts the relationship between costs of smelting under older processes and the cost under the Carson method can be shown. The Carson Investment Company holds that the advantage of the Carson furnace over the furnace used by the American Smelting & Refining Company in 1907 was the measure of damages that the Carson company is entitled to recover. The defendant company contends that the measure of damage is represented by the advantages of the Carson furnace over the improved furnace used by the smelting company in 1914.

North Butte Officials Confer on Reopening of Mine

Officials and directors of North Butte Mining, including William P. Jahn, of Milwaukee; T. E. Murray, of Duluth; C. A. O'Leary, of St. Paul; and Paul A. Gow, of Butte, recently held a conference in Butte at which plans were made for the immediate resumption of operations at the company's Granite Mountain shaft, on Butte hill, and at the Main Range workings in the eastern part of the city. The receivership has been practically lifted, and the property has been returned to the company. All indebtedness has been paid off, and the company has about $600,000 in working capital available.

New Chimney Completed at Nevada Con. Smelter

A NEW roaster chimney has been completed at the smelter of Nevada Consolidated Copper, at McGill, Nev. Chimney and foundation were designed by the Alphons Custodis Chimney Company, designers and builders of some of the largest and tallest chimneys in the world. The chimney, which is but a short distance from the roaster building, eliminates approximately 800 ft. of brick flue connecting up with the old chimney. A Cottrell dust precipitating plant and short flues will connect the new chimney with the roasting furnaces. Construction of the Cottrell plant will start this month.

The new chimney has an inside diameter of 20 ft. and rises 350 ft. above the foundation. Reinforced concrete has been used as a foundation for the chimney. The foundation is 60 ft. in diameter at the bottom and extends 15 ft. into the ground. The chimney consists of the main shaft and an inside acid proof lining. This lining, 4 in. thick, is separated from the main shaft by 2-in. air space.

A lightning rod has been installed, consisting of twelve copper-platinum tipped pointers, with two ¾-in. cables for ground connections. The old 300-ft. reverberatory chimney is being repaired, after twenty years of service. Flue dust accretion on top is being removed.

Whitworth Options Paukwab Tin, in South West Africa

WHITWORTH FINANCE & MINING, a London company, which already controls properties in Alaska and Queensland, has secured an option on the Paukwab Tin property, in South West Africa. This company plans to develop and equip the mine to produce 300 tons of ore, containing 1.5 per cent tin, daily. The mine was discovered by Otto Ortner shortly before the World War. A syndicate was formed, but the war started, and nothing was done till 1920, when London interests formed a company. Lack of capital hampered the enterprise, but such development as could be carried out resulted favorably. Whitworth Finance & Mining finally secured control on the recommendation of Dr. C. B. Horwood.

Along the eastern flank of Paukwab Mountain, on which the mine is situated, occur several well-defined lodes or outcrops of felsite and granite, rich in tourmaline, frequently containing visible tetragonal crystals of cassiterite. Mica is entirely absent over large areas, and the matrix consists of a cryptocrystalline mixture of quartz and feldspar. At certain points, the mineral-bearing bodies contain mica (muscovite and occasionally biotite), and in these areas the lodes are truly granitic. Where the lodes intersect, as in the eastern section, frequent small dislocations occur. Concentration of ore is probably at the points of intersection.

Lack of Funds Causes Delay in Printing Report, Turner States

By Paul Wooton
Special Washington Correspondent

AS MANY complaints have reached the Committee on Mines and Mining of the Senate because of the delay in publishing the results of work done by the U. S. Bureau of Mines, Senator Oddie, the chairman of the committee, went into that question at the recent hearing before the committee. This hearing was held for the purpose of developing for a printed record the exact status of the government's efforts to co-operate with the mining industry. The trouble in connection with the printing of the Bureau's results is brought out thoroughly in the questions asked by Senator Oddie on that occasion. As some time will elapse before the printed copy of the hearing will be available, the following extract is taken from the stenographic transcript:

Senator Oddie. The question has been raised by mining men as to why a charge is now made for publications of the Bureau of Mines, whereas in the past they have been distributed free. Can you explain this?

Mr. Turner. The change in method of distribution was necessitated by the difference in the rules of the Department of Commerce as compared to those of the Department of the Interior, from which the Bureau was transferred on July 1, 1925. Bureaus of the Department of Commerce distribute most of their documents through the Superintendent of Documents, at prices covering the actual cost of printing; this policy is designed to conserve printing funds and to thereby make possible the publication of more reports.

Senator Oddie. Does the Bureau of Mines bear the cost of composition?

Mr. Turner. The Bureau is charged with the cost of composition, and printing of the limited edition sent free by it to government organizations, educational institutions, scientific societies, large libraries, etc.; the cost of printing the sales editions, distributed by the Superintendent of Documents, is borne by that official.

Senator Oddie. Are printing funds appropriated direct to the Bureau of Mines?

Mr. Turner. Under the Department of the Interior they were. Since the Bureau was transferred to the Department of Commerce such funds are not appropriated directly to the Bureau, but are allotted to it from a general printing fund of the Department of Commerce.

Senator Oddie. How much did the Department of Commerce get for the current year for this purpose?

Mr. Turner. $715,000.

Senator Oddie. How much of this did the department allow the Bureau of Mines?

Mr. Turner. $75,000.

Senator Oddie. Do you happen to know what some of the other bureaus of the department got?

Mr. Turner. I believe the Bureau of Foreign and Domestic Commerce received in the neighborhood of $240,000. Most of the bureaus of the department are not publishing bureaus in the sense that the Bureau of Mines is.

Senator Oddie. Is the $75,000, allotted you by the department for printing this year, going to be sufficient for your needs?

Mr. Turner. No, it is insufficient. The estimated requirements for all the Bureau's printing this year is $140,000, leaving a shortage of $65,000. As a matter of fact, the Bureau has on hand, at the moment, manuscripts awaiting printing, the cost of printing which would be $11,250, whereas manuscripts at present in preparation will involve a printing cost of $76,550. Other miscellaneous printing needs for the Bureau for the balance of the year total $3,750. As against this, the Bureau has something less than $27,000 available until the end of the year.

Senator Oddie. Will the present situation improve or grow worse?

Mr. Turner. The effect of the small allowance for printing will be that the Bureau will continually fall behind in the publication of the results of its investigations, unless publication can be made through outside agencies, societies, organizations, or technical journals.

Senator Oddie. How much more would the Bureau require in order to keep its publications current with the preparation of its manuscripts?

Mr. Turner. An additional $25,000 per year would help, but the bare requirements of the Bureau indicate an annual increase of at least $50,000 over our present allotments.

Senator Oddie. We often hear of the delays experienced by government in printing. What causes this?

Mr. Turner. Shortage of funds is perhaps the principal cause, as far as the Bureau of Mines is concerned.

Senator Oddie. Does the Public Printer co-operate in every way to make prompt publication possible?

Mr. Turner. Our records show that the average delay in the office of the Public Printer, from the time the corrected manuscript is delivered to him until the printed publication is available, is more than three months; in some cases, we have noted delays of six months.

Senator Oddie. When the Congress is adjourned, I should think the Public Printer could catch up with his work.

Mr. Turner. It would certainly be desirable, but I understand the night force in the Printing Office is laid off after the adjournment of Congress.

Senator Oddie. If this force were continued at work for a few months would it result in government printing becoming practically current?

Mr. Turner. It would seem so.

Senator Oddie. Then it evidently is not within the power of the Bureau to better its position as to printing and publishing.

Mr. Turner. No, the Bureau can do very little. Most of the factors producing this state of affairs are entirely beyond the Bureau's control.

Senator Oddie. Do you think the old arrangement, whereby the Bureau had its printing allotments direct, rather than through the department, was a better arrangement?

Mr. Turner. It is reported to me that it was more satisfactory.

McCoy Nevada Obtains Good Results on 100 Level

DEVELOPMENT of the property of McCoy Nevada Gold Mines, in Lander County, Nev., which was started in the early summer of 1928, has reached the 100 level, according to B. P. Howell, engineer in charge, and is showing good results. The ore at this property occurs in hornblende diorite, and possibly also in contacts of the diorite with limestone. A vertical shaft continued in ore from the surface to 40 ft., showing about $30 in gold and silver. At this level, the vein dipped slightly out of the vertical shaft, which was continued downward in the footwall. At 50 ft. and 100 ft. crosscuts were driven to the vein. On the 50 level the orebody was 10 ft. wide.

The crosscut on the 100 level struck the orebody 49 ft. from the shaft. At present the drift is 18 ft. in ore. Ore on both the 50 and 100 levels has been higher grade than that mined near the surface. It occurs within the walls of a nearly vertical fissure, and the fissure filling is not unlike that deposited by thermal springs. Vein material contains skeletons of jaspar quartz that with other hydrous silica minerals appears to form the framework of the ore deposit. The ore contains a large quantity of fine material resembling pulverized geyserite in which the valuable minerals are concentrated with a silver-gold ratio of approximately 4.5:1. Outside the oreshoot proper, occurrences have been noted of heavy sulphides carrying up to 225 oz. silver and 2 oz. gold per ton—this despite the oxidized nature of the oreshoot itself at the greatest depth attained.

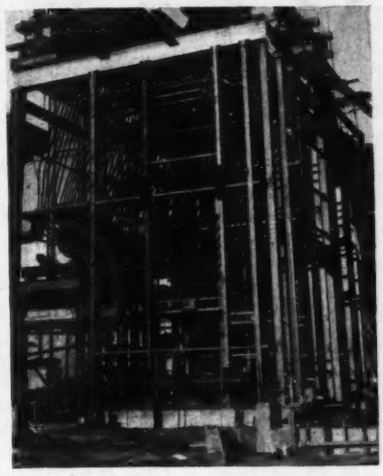
The McCoy property is equipped with a 40-hp. Novo engine, hoist, Rex-Gardner compressor, and Cochise drills. Recently the company decided to operate some of its holdings on a lease basis, and such operations will begin soon.

Porcupine United Mill to Start Operations Soon

Porcupine United Gold Mines, which recently took over the Canadel, Rochester, and Canadian Mines properties, in the Porcupine district of Ontario, has erected a 100-ton mill and will soon begin production with electric power. A shaft has been put down to a depth of 947 ft. and five levels have been driven, on which work is being done.

Grandview Mill Starts

The first unit of the concentrator of Grandview Mines, in the Pend Oreille district, of Washington, recently went into operation. It has a capacity of 350 tons, but operations are expected to reach an output of 2,400 tons daily. The enterprise is a large, low-grade lead-zinc operation. The present operation is largely for adjustment, although some concentrate may be produced.



New Sources of Power for Miami Copper Operations

ONE of the Heine boilers now being installed by Combustion Engineering at the power plant of Miami Copper, in the Globe-Miami district of Arizona, is shown in the accompanying illustration. Three additional boilers are being installed in back of this one. Two of these are already inclosed and in use. The boilers are 720 hp. and operate at 400 to 425-lb. pressure, compared with the old 200-lb. pressure system. This power installation forms part of the program of expansion now being carried out at the company's property, as outlined in the March 2 issue, on p. 373.

Sherritt-Gordon to Sink New Shaft in Western Ground

AT THE property of Sherritt-Gordon Mines, in northern Manitoba, preparations for the sinking of a third shaft are being made. This new opening, in the west end of the property, will be sunk 1,500 ft. on the incline. At the east shaft, the orebody has been opened for a length of 2,400 ft. by crosscuts at 100-ft. intervals. At the central shaft 3,500 ft. of development work has been done. In both of these shafts, the orebodies are maintaining the grade indicated by diamond drills. This is approximately 3 per cent copper, 3 to 4 per cent zinc, and $1 in gold and silver. About 6,000,000 tons of this grade have been indicated to comparatively shallow depths, according to data contained in recent estimates.

Large quantities of supplies are being brought into the property, and the tractors are handling 40 to 50 tons a day. Good progress is being made in the construction of the 42-mile railroad from the Flin Flon mine. Construction of the building for housing the concentrator will be started this summer, but the equipment, to have a daily capacity of 1,500 tons, will not be installed until the railroad has been completed. In the meanwhile, a test mill is being erected.

Nevada Hills Completes Installation of New Hoist

The new electric hoist and other equipment for the winze from the 900-ft. level at the Virginia mine of Nevada Hills Mining, near Coulterville, Calif., has been installed, and two shifts are now sinking below the 1,050 level in good milling ore, according to Frederick B. Hyder, consulting engineer, and A. M. Allison, secretary-treasurer. Timbers are going in for the new raise from the 900 level, and everything will soon be in readiness to place the mill on steady production.

Two More Mining Engineers Captured in Mexico

THE Department of State, at Washington, has been informed by Ellis A. Bonnet, the American vice-consul in charge at Durango, to the effect that Henry Hanson, the American resident manager of the San Nichols Mining & Milling Company, and J. W. Reid, a British subject employee, were both captured on March 1, at Vocas, Durango, by about 100 rebels, who demanded 24,000 pesos, 200 overalls, 50 blankets, and three kegs of horse-shoe nails. The vice-consul adds that Mrs. Hanson is at Durango and that Mrs. Reid is at Vocas. The head office of the San Nichols Mining & Milling Company is in the Stock Exchange Building, Los Angeles.

Mr. Bonnet states that he has informed the American Embassy at Mexico City of the above-mentioned occurrence.

The American Embassy at Mexico City was informed that telegraphic advices from the commander of the federal forces pursuing the bandits who killed J. M. Underwood and C. C. Aisthorpe, American employees of the Guanajuato Reduction & Mines Company, reported that an engagement lasting two hours had taken place between the federal forces and the bandits, resulting in the complete defeat of the bandits, who lost ten men. Two prisoners, ten horses, and nine rifles were reported captured by the federal forces. The pursuit was being continued and Ambassador Morrow was assured that it would be pressed until the leader of the bandits has been captured.

Later the Embassy was informed that another dispatch had been received from the commander of the federal forces reporting that the federal troops had killed seven more of the bandits and captured five. These are in addition to the ten above reported.

The revolution that broke out in Mexico on March 3, centering in Vera Cruz and Sonora, but including most of the northern and southern extremes of the republic, has not as yet affected operations at any of the important copper producers in northern Sonora. A report from Greene Cananea states that no disturbance has occurred there to interfere with operations. No word has been received from the Moctezuma branch of Phelps Dodge, but no reason exists to believe that anything untoward has happened. The *Wall Street Journal*, in commenting on the situation, says:

"To interfere with employment would not add to the popularity of the uprising, and mines are in Mexico an important source of employment, as Mexico is an especially important producer of silver and lead. The three last-named companies (Howe Sound, American Metal, and A. S. & R.) seem as yet to be outside the disturbed regions. Later, if railroad tracks are torn up, operations at some of the properties might become hampered."

Durango Smelter Closed Temporarily by Snow

OPERATIONS have been temporarily suspended at the Durango smelter of American Smelting & Refining, in the San Juan basin, of Colorado, and will not be resumed until train service between Silverton and Durango is again available. The Durango smelter depends on the Sunnyside mine, of U. S. Smelting Refining & Mining, for most of its ore, and the recent avalanches that have isolated Silverton have cut off this supply entirely. No trains have been run over the 45-mile branch line of the D. & R. G. W. between Durango and Silverton since the beginning of February. Considerable criticism has been leveled at the management of the railroad by the inhabitants of Silverton because of the slow work of cleaning up the slides. However, operations in the district have not been affected. In fact, one company, the Pride of the West, started operations at its new mill, on Cunningham Gulch, during this period and is now accumulating lead concentrate for shipment when train service is resumed.

Connell Fails to Exercise Option on Abana Shares

With his failure to purchase 62,500 shares of Abana Mines at $3.50 a share, F. M. Connell has dropped his option on the balance of 500,000 shares. A comparatively small block of stock was taken over when the option was agreed on. The second block of 62,500 shares had to be paid for on March 1. These shares were owned by Vickers Mines, Ltd. A recent official report on the mine by the president of the company states that a diamond drill had intersected the No. 2 orebody at a depth of 500 ft., west of the dike, and that it shows a good width of ore. The work at the mine is being carried on with four drills and two diamond drills.

Johannesburg Letter

By Owen Letcher
Special Correspondent

British Government May Try to Break Belgian Control of Radium Production

Johannesburg, Feb. 2, 1929—Considerable interest has been aroused by the recent shipment of seven sample boxes of radioactive ores to Hamburg from Cape Town. The British government is reported to be considering a co-ordination of the radium supplies of the empire in the hope of reducing the extremely high cost of this metal, larger supplies of which are greatly needed. At present the price is £450,000 an ounce—or about 100,000 times the price of gold—and it is maintained at this level because of the fact that nearly the entire present supply comes from a single source, the Chinkolobwe mine, in Katanga, Belgian Congo. Ore is extracted here from open quarries and shipped to Belgium, where it is treated at Oolen, near Antwerp. Operations at Chinkolobwe have temporarily been suspended, it is reported, as the ore dumps at Oolen are sufficiently large to maintain production.

Dr. S. H. Haughton, of the South African Geological Survey, describes the Gordonia radioactive deposits in Cape province as existing in the form of pegmatite dikes, which cut the granite underlying the upper sedimentary rocks and surface sands. The deposits are very limited in number, although the pegmatite dikes are numerous. The discoveries are on farms within 35 miles of the railroad. Samples produced were high in radium content, although hardly as rich as the ore which comes from the Congo.

ALTHOUGH the remarkable developments attending the opening up of the Northern Rhodesian copper belt are absorbing a tremendous amount of attention, the importance of the Belgian Congo deposits must not be overlooked. From the standpoint of development, equipment, and production, Union Minière is years ahead of any of the Rhodesian producers, and its ore reserves are much higher grade than those in Rhodesia. At present, production from the Rhodesian field is about 7,000 tons a year, which comes from Bwana M'Kubwa's Bwana mine. Union Minière, on the other hand, is producing between 115,000 and 125,000 tons yearly, and when the big leaching plant at Panda enters production, this amount will be increased to 150,000. Production from the Musonoi, or western, group of mines will bring this figure even higher, probably to 200,000 tons, which would give the company an even larger production than Utah or Chile, at present the world's largest producers.

The copper trade of Katanga has been mainly instrumental for developing two Belgian steamship lines—La Compagnie Belge Maritim du Congo and La Compagnie Africaine de Navigation. With the completion of the Lobito Bay railroad, as well as the functioning of the new rail and river route from Katanga to the mouth of the Congo, increased scope for Belgian shipping services will be afforded. The first ships of the new Belgian-Angola African line have called at Cape Town, indicating what may be expected in the future as a result of the increase in south-central African copper production. A step of special significance is the proposal of additional direct shipping services between the United States and South Africa, in view of the large amount of American capital invested in the Rhodesian mines.

Ardsley Butte Strikes South Vein on 500 Level

ON the 500 level of its Highland property, in the southwest part of the Butte district of Montana, Ardsley Butte Mines has struck the south vein, which has a width of 18 ft. The vein is badly shattered at this point and is laced with stringers that show high-grade copper, with some silver. One of the walls is serpentine. The vein will be drifted on to the west. The raise from the 500 level has connected with the winze from the 365 level on the Highland vein, and the intermediate level is being drifted on to the east.

Ardsley Butte Extension, which adjoins the Ardsley Butte property, has been shipping about one car of silver ore daily from its new orebody, encountered in a raise from its south vein on the 250 level.

Strike in Northern Montana Causes Excitement

Interest in the Hog Heaven district, in the southwest part of Flathead County, northern Montana, has been stimulated by the finding of high-grade silver ore in the Brown's Meadow mine, which is reported to have shipped $100,000 of ore in three months. This property was leased by the operators from Anaconda Copper, which owns a large amount of ground in the vicinity. The Northern Pacific Railroad also owns considerable territory in this district. More thorough prospecting of the region is expected as soon as the snow melts.

Reopen Old Butte Mine

Blue Bird Extension Mining has been incorporated by Madison County and Butte bankers and engineers, to acquire several claims of the Blue Bird group, in the western part of the Butte district, Montana. In the 'nineties the Blue Bird was one of the world's largest silver producers. It was shut down because of litigation and the increase in the zinc content at depth.

Mexico City Letter

By W. L. Vail
Special Correspondent

New Minister in Charge of Mining Affairs Makes No Change in Personnel

Mexico City, Feb. 25, 1929.—The new Minister of Commerce, Industry, and Labor, Dr. Ramon P. DeNegri, who is in direct charge of all mining matters, has thus far made no changes in the personnel of the mining division of his department, and it is understood that all the responsible heads, at least, will be retained. This department is now engaged in gathering statistics for the purpose of presenting the government's contention regarding changes in the present mining laws at the convention which will soon be held in this city. Some of the leading officials of the department insist that the laws are beneficial as they now stand and that much of the trouble in the industry has resulted from falling prices and has nothing to do with legislation.

UNUSUAL activity in copper deposits in northern Sonora is reported by the Mexican consul at Nogales, Ariz., as the result of the rising copper prices. Lists of applications for concessions to explore, on file in this city, also denote an increased interest in copper prospects in the states of Michoacan and Guerrero. Several low-grade deposits, abandoned since the revolution of 1910, are being redenounced. Efforts are being made to resume operations at the old Dicha properties, in Guerrero. The Dicha deposits are within a short distance of Acapulco, on the west coast, and at one time work was begun on construction of a railroad to the properties from that port.

R. Wilson and Finney Bacon, for many years actively engaged in mining in Oaxaca, have sold their properties in the Sierra Juarez and Taviche districts to a group of Alabama mining men. In the Sierra Juarez district, they owned the San Francisco mine, an old silver property, which also carried some gold. This property was worked for many years, but was abandoned about twenty years ago and has been idle since. In the Taviche district they own the Conejo Blanco mine, adjoining the San Juan property of American Smelting & Refining.

A project for continuing an automobile road from Durango to Mazatlan, via El Salto, has received the support of mining men, as it would afford an outlet for an extensive mineral region in the west coast Sierras, particularly in view of the recent construction of a lead smelter at Mazatlan. In the district near El Salto and Pueblo Nuevo, considerable interest has lately been evinced in old quicksilver mines.

MARKET AND FINANCIAL NEWS

American Metal Company Earnings Maintained in 1928

NET income of American Metal Company for 1928 was $2,651,933, as against $2,513,764 in 1927 and $2,657,309 in 1926. The consolidated surplus account for the year ended Dec. 31, 1928, is shown in the accompanying table.

Carl M. Loeb, president, says that the company has made progress in its policy of strengthening its position as a primary producer, particularly in the copper industry, through the increase of its investments in various mining properties and in new acquisitions. There has been a material appreciation in the value of these properties, which are being developed and equipped, but no return from them can be expected for some time. All such investments are carried in the company's books at cost. To provide ample working capital to carry out the aforesaid policy, the directors have authorized new financing. They have also voted to recommend to stockholders the termination of the present practice of paying "tantiemes," or percentages of net profits, to certain officers and employees.

Consolidated Surplus Account for the Year Ended Dec. 31, 1928.

Surplus at beginning of year			$10,342,321
Income from operations during year, after deducting management's share of profits under contract, and provisions for United States and Mexican federal income taxes		$4,120,980	
Less depreciation, depletion, exploration expenses, and extraordinary repairs		1,469,047	
Net income		$2,651,933	
Surplus of subsidiaries, transferred to ordinary reserves in accordance with requirements of Mexican law		35,720	
		$2,616,213	
Additions to consolidated surplus through acquisition of stocks of subsidiaries		66,416	
		$2,682,629	
Less dividends			
Preferred, at the rate of $7 per annum on 50,000 shares to date of exchange or redemption	$121,205		
Preferred, at the rate of $6 per annum on 100,000 shares as issued during the year	398,895		
Common, $3 per share on 594,904 shares, and at the rate of $3 per annum on 210 shares issued during the year	1,785,245	2,305,345	377,284
Surplus at end of year			$10,719,605

ARIZONA COMMERCIAL MINING COMPANY for year ended Dec. 31, 1928, earned $173,611 after depreciation, but before depletion, comparing with $89,128 in 1927.

BUTTE & SUPERIOR MINING COMPANY reports operating profit of $12,423 in the fourth quarter of 1928. Income from copper production was entirely lacking in the fourth quarter as a result of the exhaustion of the company's copper ore reserves.

HOWE SOUND COMPANY for quarter ended Dec. 31, 1928, reports net profit of $754,513 after taxes and depreciation, but before depletion, equivalent to $1.52 a share earned on 496,038 shares of no-par stock. This compares with $668,194 or $1.35 a share in preceding quarter and $452,360 or 91c. a share in fourth quarter of 1927.

B. & B. QUICK COMPANY, operating a quicksilver property in the Fish Lake Valley district of Nevada, increased its authorized capitalization from $200,000 to $250,000 of $1 par shares at a stockholders' meeting in Las Vegas, Nev., on Feb. 8. Shareholders are given rights to purchase one additional share of stock at par for each four shares held. Income from the new stock issue is to be used for the erection of a second rotary furnace and for paying off all outstanding indebtedness.

CONSOLIDATED LEAD & ZINC COMPANY shareholders have been offered the rights to subscribe for one additional share of common stock at $10 a share for each four shares held, F. N. Bendelari, Joplin, Mo., announced following the annual meeting of the stockholders last week. The stockholders voted to increase the capital structure from 200,000 to 250,000 shares, all to have voting privileges. The old stock was divided into 175,000 Class A nonvoting shares and 25,000 Class B voting shares. Proceeds from the sale will be used to retire funded debts contracted when the company recently purchased the Jack and Jill, Kitty., and Domada mines from Domada Mining. F. N. Bendelari was re-elected president, George Potter, vice-president and Vernon Jones, secretary.

Wright-Hargreaves Earnings Declined in 1928

THE annual report of Wright-Hargreaves Mines, Ltd., of Kirkland Lake, shows that during 1928 a total of 256,331 tons of ore was milled, with bullion recovery amounting to $1,845,923, or an average recovery of $7.20 a ton. The total cost per ton milled, including exploration and development, was $5.33, and the profit realized was $478,517. The mill treated an average of 700 tons daily. Profit-and-loss statement for 1928 follows:

Bullion production			$1,845,923
Operating costs			
Development and exploration	$326,863		
Stoping	349,332	676,195	
Transporting ore (hoisting, etc.)		231,227	
Milling charges		270,945	
Market bullion		12,803	
New road and general surface construction		5,866	
Stock transfer and registrar charges		19,692	
General and undistributed charges		107,664	
Depreciation		43,009	1,367,406
From operation			$478,517
Other income:			
Exchange		1,417	
Interest		34,798	
Rent		3,791	
Purchase discounts earned		1,401	
Miscellaneous		3,892	45,301
Net to surplus			$523,818

President Oliver Cabana, Jr., states that the low-grade ore encountered late in 1927 persisted quite regularly throughout the year, as a result of which operations were disappointing and the company did not succeed in earning its dividends. On account of the problems confronting the officials, M. W. Summerhayes was engaged to make a thorough survey of the situation, and his report is now being considered by officials of the company. A report on the geology and general structural conditions of the mine, prepared by E. W. Todd and included in the report, is favorable in so far as structure is concerned. The two main zones of fracturing continue to hold their strength on the deepest level opened up, and favorable structure is known to continue into the outlying parts of the property.

Continuation of the present policy of intensive exploration of the several favorable sections of the mine, as well as the opening up of new oreshoots already indicated, is of primary importance. In Mr. Todd's opinion all other circumstances should be considered as of secondary importance. During the last four months of the year fast progress was made in opening up the veins. As development work progressed, favorable results were met with in the easterly portion of the mine.

London Financial News

By W. A. Doman,
Special London Correspondent

London, Feb. 19, 1929.—As indicated last week, the Russo-Asiatic Consolidated appears to be coming into its own again. Full details of the provisional agreement are not yet available, but Leslie Urquhart has been interviewed on the subject, and has given some rather significant hints. Here in substance is what he says, and in this connection it has to be remembered that he had previously claimed from the Soviet government £56,000,000 as the value of the various properties that had been confiscated. For some time he was not persona grata with the authorities, owing presumably to his outspokenness. But the Soviet has not the money, nor the machinery, nor the technical staff to work the different mines, and apparently its representatives have at last come to the conclusion that it would be advisable to make some sort of a bargain. It seems fairly certain now that something will happen. Mr. Urquhart says it is quite true that the corporation's negotiations with the Soviet government in regard to the return of its Russian properties have taken a decisive turn. Negotiations have been in progress for several months, meetings having taken place with M. Piatokov, the Soviet representative in Paris, which resulted in such an agreement of views that the corporation was able, at the request of M. Piatokov, to state in writing the general principles on which it would be possible to enter into an agreement with the Soviet government. The corporation has now been informed that, with certain small modifications to which it has assented, these principles have been accepted by Moscow, and the president of the Concessions Committee is obtaining authority to negotiate the details and sign a preliminary contract abroad. Until actual agreement and signature, an official statement will not be made. When this preliminary contract is signed, the corporation's representatives will investigate the position on the spot. The Guggenheims and Harrimans, it is said, wish to participate in Russo-Asiatic activities, and are willing to pay a fairly high price for a block of shares. In this connection it may be mentioned that Russo-Asiatic owns the control of the Mount Isa Mines, in Queensland, and has also acquired exclusive mining rights over 10,000 square miles belonging to the North Charterland Company in Northern Rhodesia. The shares which the American groups will purchase will, it is understood, be introduced to the New York Curb Market.

With the wobbling in prices that is taking place on the New York Stock Exchange, consequent upon the warnings issued by the Federal Reserve Board, fears are being entertained on this side that American purchasers of Northern Rhodesia Copper shares will throw them on the market. So far as I can gather, however, this would not appear to be probable, for the firms that have bought the shares did not, it is understood, buy for a few shillings' profit but for the long pull and in order to have an interest in the development of the African copper industry.

The British South Africa Company has just issued its report and accounts for the twelve months to Sept. 30, 1928, and it is remarked therein that in Southern Rhodesia the outlook for the asbestos and chrome industries has materially improved, and gold mining is more encouraging. In Northern Rhodesia copper discoveries have been so remarkable that the eventual production of big tonnages seems assured.

Silver King Coalition Reports Net Income of $1,489,706

Silver King Coalition Mines Company, operating in the Park City district, Utah, reports net income of $1,489,706 in 1928. Dividend disbursements totaled $1,342,513, leaving $150,028 to be added to the company's surplus fund as a result of the year's operations. The profit-and-loss statement follows:

Operating revenue from ore sales—			
Net smelter returns after deducting freight and treatment charges			$3,398,011
Other income			
Interest on securities	42,431		
Miscellaneous income	16,505	58,937	
Total income			$3,456,948
Operating expenses			
Mining and milling expense	1,616,112		
Taxes (state and county)	112,255	1,728,367	
Administrative	50,159		
Federal taxes	114,196	164,356	
Depreciation			
Plant and equipment		74,517	
Total operating expenses			1,967,241
Net income			$1,489,706

A total of 24,685 ft. of development work was completed during 1928, which compares with a total of 14,496 ft. in 1927. Metal production for 1928 is compared with that for 1927 and 1926 in the accompanying table:

	1928	1927	1926
Gold, oz.	3,437	3,311	2,773
Silver, oz.	2,763,161	2,438,256	1,792,300
Copper, lb.	1,636,940	1,372,536	999,671
Lead, lb.	39,406,449	38,128,833	33,911,773
Zinc, lb.	10,275,078	10,318,932	8,421,164

The company reports that particular attention has been given to research and experimental work in the concentrating mill during the past year, resulting in increased efficiency of mill operations and the profitable treatment and separation of the lead and zinc content in the high-grade complex ore, heretofore shipped as crude ore, thereby noticeably decreasing the tonnage shipped and increasing the metallic content of the product sold, and resulting in a reduction of freight and treatment expenses. The foregoing in connection with the increased mill saving and lower cost per ton mined and milled contributed materially to the increased revenue of the company.

Calumet & Hecla's Fourth Quarter Earnings Total $2,433,023

Calumet & Hecla Consolidated Copper Company's report for the fourth quarter of 1928 shows an operating profit of $2,433,023, equivalent to $1.21 per share, and net profit carried to surplus, after depreciation and depletion, of $1,206,213, or 60c. per share. Total receipts were: $6,248,664; disbursements: $5,930,917. Copper on hand Dec. 31, 1928, was valued at $2,115,276. Depreciation was $520,117 and depletion $706,691.

Regarding dividends paid in 1928, Calumet & Hecla Consolidated has advised its stockholders that the dividends were partly out of current earnings, which are subject to federal income tax, and partly out of surplus, considered non-taxable under the Revenue Act of 1928, as follows:

Dividend Paid	Taxable	Non-Taxable
March 15	32.713 c	17.287 c
June 15	38.987 c	11.013 c
Sept. 15	38.987 c	11.013 c
Dec. 15	38.564 c	61.436 c

Shareholders are advised to include as taxable income in their federal income tax return only such portion of each dividend as is shown in the "taxable" column.

Investigates Non-Ferrous Metal Freight-Rate Structures

On Jan. 12, 1929, the Interstate Commerce Commission issued a notice announcing a general investigation of rates on slab zinc and inviting suggestions as to the scope of that investigation. Upon consideration of the suggestions received in response to that notice it is deemed desirable to broaden the investigation to include rates on copper and lead, as well as the ores, concentrates, and secondary sources of all three metals. For this purpose No. 17,000, "Rate Structure Investigation" affords an appropriate vehicle. Accordingly it is the commission's intention to assign this proceeding for hearing at times and places to be hereafter announced, in so far as it involves rates upon the following commodities, domestic, import, and export:

Copper, Brass or Bronze Bars (rough cast), Cakes, Pigs, or Slabs; Copper Ore; Copper Concentrates; Copper Ashes, Skimmings, Sweepings, and Washings; Scrap Copper, Brass, or Bronze; Copper Brass or Bronze Borings and Turnings; Copper Slimes or Mud; Blister Copper; Copper, Brass or Bronze Ingots and Anodes.

Lead, Pig or Slab; Lead Ore; Lead Concentrates; Lead Matte; Bar, Block, and Ingot Lead; Antimonial Lead (not type metal or babbitt); Scrap Lead; Lead Dross, Skimmings, and Ashes.

Zinc, Pig or Slab (Spelter); Zinc Ore; Zinc Concentrates; Zinc Dross, Skimmings, and Ashes; Scrap Zinc; Zinc Anodes.

The hearings will probably not be begun before about 90 days from March 1.

U.V.X. Net Income $1,020,025 in 1928; Compares With Net Loss in 1927

NET INCOME of the United Verde Extension Mining Company in 1928, after allowing for depletion and depreciation, was $1,020,025, as against a net loss of $533,771 in 1927. Dividend distribution during 1928 totaled $2,100,000, of which $1,079,975 was drawn from the company's surplus fund. Statement of earnings for 1928 follows:

Gross revenue from copper, gold and silver sold		$7,147,438
Other revenue		599,279
		$7,746,717
Deductions		
Mine and smelter operating, freight, refining and selling expenses	$3,295,987	
Other expenses including taxes	625,308	3,921,296
		$3,825,421
Less		
Amounts written off to reserves:		
Depletion	$2,346,709	
Depreciation	458,685	2,805,395
		$1,020,025

The company mined 256,170 tons of ore in 1928, assaying 8.85 per cent copper, 0.038 oz. gold, and 1.62 oz. silver. In 1927 the company mined 244,912 tons of ore assaying 8.38 per cent copper, 0.04 oz. gold, and 1.69 oz. silver.

Ore reserves at the end of 1928 totaled 778,620 tons of ore, assaying in excess of 8 per cent copper. Ore reserves at the beginning of 1928 were approximately 960,000 tons of corresponding grade.

The U.V.X. bodies are all on the hanging-wall side of the great Verde fault, and until a year ago hope had been entertained that the roots from which this ore originated, or other orebodies, would be found within the boundary lines of the company's property. Following constant development work prosecuted since 1912, the company has been forced to accept the fact that its orebodies did not originate from roots located within its own boundaries, but were faulted off the top of the mine of the adjoining United Verde property, and the consequent acceptance of this long-suspected theory, as a fact, obviously precludes the possibility of the discovery of ore below the level of the bottom of the present U.V.X. orebodies.

Extensive development work to the north and east in Jerome Verde ground and to the south in U.V.X. ground has been unproductive of ore discoveries, and the company is in the position of being obliged to accept the foregoing figures of ore in sight and to realize that the probabilities of the discovery of further ore are exceedingly remote. The physical condition of the property is reported as excellent.

A visit of Fred Searls, Jr., and James S. Douglas, to the Cape Copper property, in South Africa, confirms the favorable information given to stockholders last November. Elsewhere than at the Cape and at Jerome development work is being prosecuted, but as yet nothing in the nature of a positively profitable mining enterprise has resulted.

VENTURES LTD. is creating a great deal of interest in Canada recently because of its proposal to issue 100,000 shares of stock. Indications are that this stock will be put out at $8 a share and subscriptions have already been received for ten times the amount available, according to report. Ventures Ltd., which recently became associated with Consolidated Mining & Smelting, for the construction of a copper and zinc refinery in eastern Canada, is capitalized at 10,000,000 shares. The first issue was privately subscribed for at 60c. per share, and the money raised was put into options and shares, some of the shares including those of some Northern Rhodesian copper mines. The original charter of the company provided that stock could be issued at a price not exceeding $1 per share. Subsequently it was decided to raise this to $5 a share, but in view of more recent developments and the great growth of the company's assets, a special meeting is being called to raise the $5 maximum to $25.

Imports and Exports of Ores and Metals in January, 1928 and 1929

Compiled from U. S. Department of Commerce Records

In Pounds, Unless Otherwise Stated

Imports

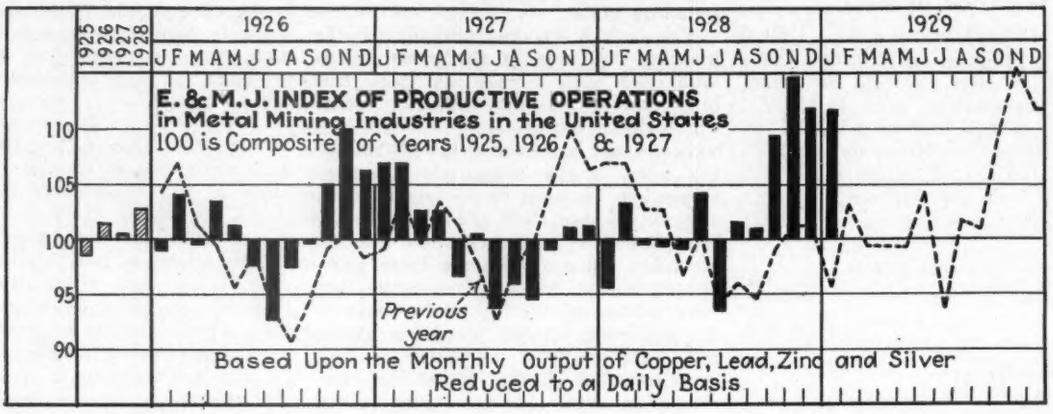
	January 1928	January 1929
Antimony:		
Ore { Gross weight	49,800	986,759
Ore { Antimony content	20,920	588,431
Copper		
Ores, copper content	8,686,607	12,921,688
Concentrates, copper content	2,515,260	5,256,332
Regulus, coarse metal, cement copper	220,700	110,000
Imported from:		
Spain	1,618,587	515,375
Canada	3,949,456	6,934,175
Mexico	3,686,564	2,371,186
Cuba	806,100	1,560,000
Chile	789,766	5,249,007
Peru	92,526	1,587,515
Other countries	479,568	70,762
Unrefined black, converter copper in pigs, bars and other forms	35,802,711	45,290,481
Refined copper	5,319,153	12,864,398
Old and clippings for remanufacture	1,170,028	549,382
Composition metal, copper chief value	.....	11,200
Brass, old, for remanufacture	775,684	1,186,426
Lead		
Ore and matte, lead content	2,786,480	6,643,658
Bullion or base bullion	18,041,226	39,204,814
Pigs and bars	8,880	.....
Babbitt, solder and other forms { Lead content	83,708	107,960
Babbitt, solder and other forms { Gross weight	187,302	218,407
Type metal, antimonial lead { Gross weight	.....	2,095,194
Type metal, antimonial lead { Lead content	.....	2,010,984
Manganese, tons:		
Cuba, manganese content	80	252
Other countries, manganese content	9,291	15,344
Pyrites, tons	55,294	58,964
Tin, ore, tons	3	9
Bars, blocks, pigs	12,828,385	21,275,222
Imported from:		
Netherlands	1,627,182	1,891,108
United Kingdom	1,528,706	5,760,362
British Malaya	9,179,602	11,772,639
Netherland East Indies	114,270	.....
Honkong	33,716	858,783
Australia	112,000	297,920
Other countries	232,909	694,410
Zinc		
Ore, zinc content { Free, less than 10 per cent zinc	22,549	.....
Ore, zinc content { Dutiable	289,100	3,286,127

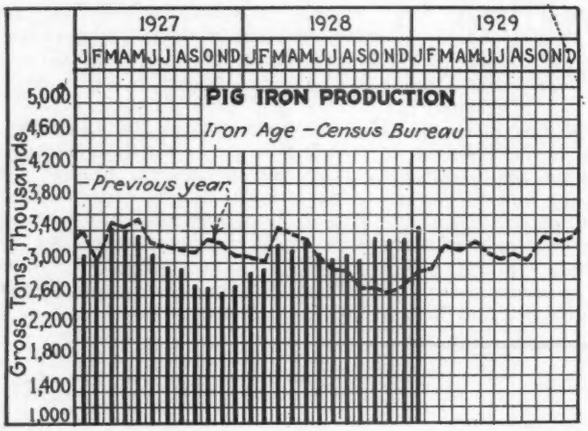
Exports

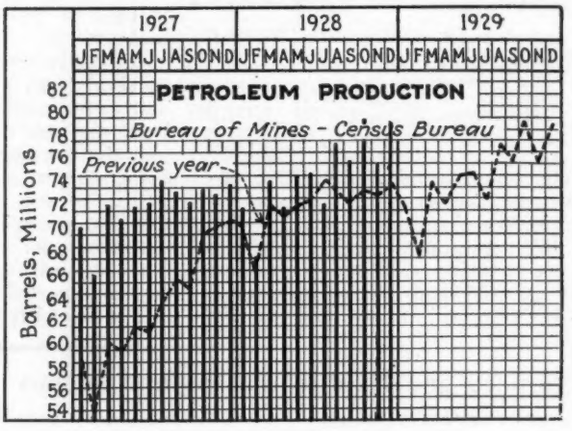
	January 1928	January 1929
Copper		
Ores, composition, concentrates, unrefined	216,410	381,138
Refined copper in ingots and other forms	91,415,483	89,998,320
Exported to:		
Belgium	8,097,051	3,489,488
France	17,187,724	20,036,340
Germany	21,860,797	17,996,978
Italy	8,318,686	16,035,481
Netherlands	10,507,733	4,554,944
Spain	672,398	33,710
Sweden	1,562,831	3,765,252
United Kingdom	15,899,813	13,726,167
Other Europe	4,519,766	5,172,172
Canada	1,376,781	1,003,694
British India	168,000	224,000
China, Hongkong and Kwantung	208,576	1,310,400
Japan	839,758	1,791,154
Other countries	195,619	858,540
Old and scrap	4,965,528	5,539,900
Pipes and tubes	161,668	210,572
Plates and sheets	645,691	680,565
Rods	5,776,206	6,980,382
Insulated copper wire and cable	1,304,452	2,430,364
Lead		
In pigs, bars and other forms		
From domestic ore	96,792	2,175,952
From foreign ore	17,586,140	12,686,772
Exported to:		
Belgium	1,100	.....
France	1,008,161	224,036
Germany	4,738,816	2,643,735
Netherlands	1,322,043	459,392
Sweden	1,131,885	1,355,780
United Kingdom	5,153,295	6,722,089
Other Europe	280,105	616,229
Brazil	396,481	682,350
Other South America	263,979	496,909
China, Hongkong, Kwantung	560,438	.....
Japan	2,746,706	1,568,882
Other countries	79,923	93,322
Other lead manufactures	1,257,699	1,318,372
Zinc		
Ores and concentrates, tons	2,064	.....
Dross	287,779	1,090,171
Cast in slabs, blocks and pigs	9,287,924	2,572,475
Exported to:		
Belgium	221,216	63,599
France	1,282,361	778,630
Germany	1,633,722	593,757
Italy	67,224	.....
Netherlands	395,076	150,253
United Kingdom	313,595	515,315
Other Europe	134,377	.....
Japan	4,884,442	448,006
Other countries	355,911	22,915
Sheets and strips, other forms	620,160	593,507
Dust	186,948	70,795
Other zinc manufactures	164,030	75,477

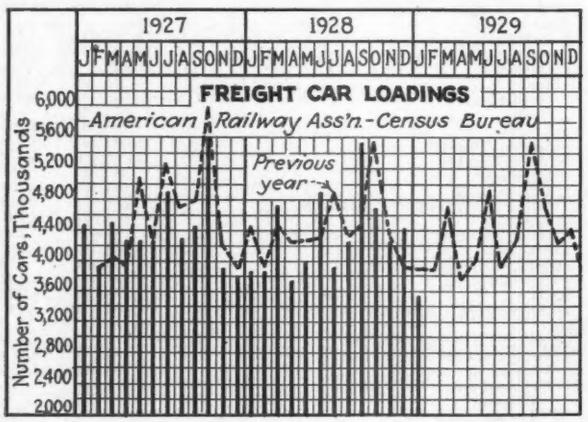
Indicators of Industrial Activity

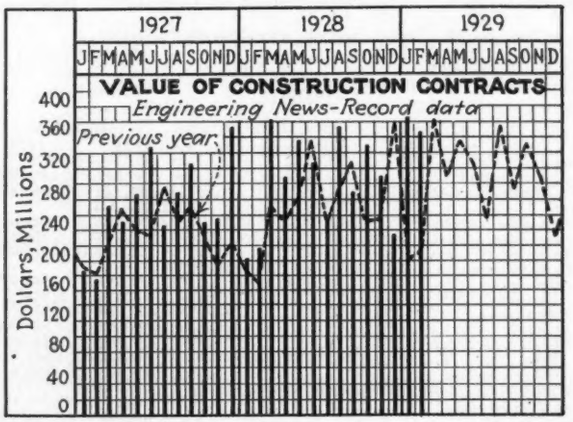
of Significance to Mining

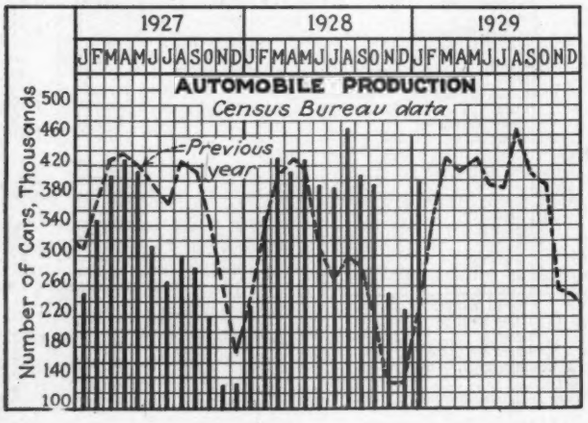


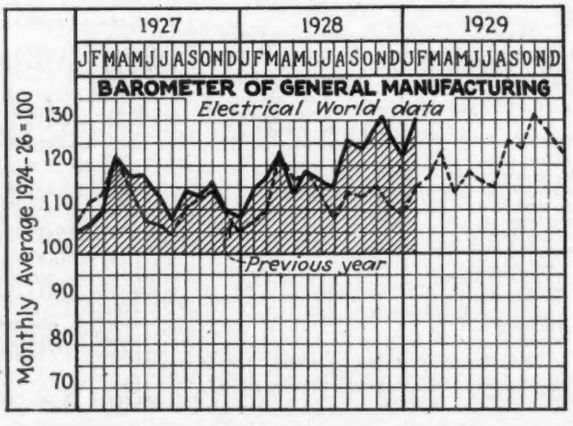












The Market Report

Copper Goes to 19½c., Lead to 7¼c.

New York, March 6, 1929—Copper, after advancing to 19¼c., delivered, has quieted down, leaving lead as the most active metal, with the price going to 7¼c., New York, today. Zinc, tin, and silver are all substantially unchanged in a quiet market.

Copper advanced rapidly in the closing days of February and started the new month at 19½c., delivered Connecticut, which price has since been maintained. Consumers have not been insistent buyers, feeling that not a great amount of copper was being offered, and that booking orders of any size would only run the price up further. The volume of sales, therefore, has been light, with April, May, and June in about equal demand. Consumers are, however, largely bought through May, and fairly well into June.

The export price advanced from 18¾c. to 19¼c., c.i.f., on Feb. 28; to 19½c. on March 1; and to 19¾c. on March 2. Sales in the foreign market in the last week have been at about the usual rate.

Daily Prices of Metals

Feb. March	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
28	18.80	48.875	7.10@7.15	7.00	6.35
1	19.275	48.875	7.10@7.125	6.975@7.025	6.35
2	19.275	48.875	7.10	7.00@7.05	6.35
4	19.275	48.875	7.10@7.15	7.00@7.025	6.35
5	19.275	48.875	7.10@7.15	7.00@7.025	6.35
6	19.275	48.625	7.25@7.275	7.15	6.35
	19.196	48.833	7.142	7.033	6.350

Average prices for calendar week ending March 2, 1929, are: Copper, 18.658; Straits tin, 48.938; N. Y. lead, 7.073; St. Louis lead, 6.975; zinc, 6.350; and silver, 56.313.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Feb. March	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
28	82⅝	83⅜	88½	220½	222⅜	23⅞	23⅞	26⅜	26 7/16
1	83⅜	84 13/16	89½	220½	222⅛	23¾	23 13/16	26¼	26½
4	82⅜	83⅝	91	219¾	222½	23⅝	23⅝	26 7/16	26⅜
5	83½	84 13/16	91	220	222⅜	23 11/16	23 13/16	26⅜	26 9/16
6	82½	83⅞	91	219¼	221¼	23 11/16	24	26 3/16	26½

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Feb. March	Sterling Exchange "Checks"	Silver		Gold London	March	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
28	4.84⅜	56½	26⅛	84s11½d	4	4.84⅜	56½	26	84s11½d
1	4.84⅜	56¼	26	84s11½d	5	4.84⅜	56¼	25 15/16	84s10⅞d
2	4.84⅜	56¼	26	.....	6	4.84⅜	56⅜	26	84s11¼d

Average, 56.354

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Average Metal Prices for February, 1929

COPPER:	
New York Electrolytic	17.727
London Standard Spot	78.228
London Electrolytic Spot	83.538
LEAD:	
New York	6.853
St. Louis	6.739
London Spot	23.128
London Forward	23.156
SILVER:	
New York	56.210
London	25.904
Sterling Exchange	484.787
ZINC:	
St. Louis	6.350
London Spot	26.247
London Forward	26.347
TIN:	
Straits	49.347
London	223.138
QUICKSILVER	119.818
ANTIMONY	9.548
PLATINUM:	
Refined	70.000
Crude	60.000
ALUMINUM 99 Per Cent Plus	24.300

Mexican Scare Affects Lead

Possibility of a disturbance in the flow of Mexican lead has served to enhance the lead-market activity during the last few days, especially because of the prevailing high rate of domestic consumption and the strong position of producers. Numerous sales in the East at premiums over the A. S. & R. contract price have been reported. Today the Smelting company's contract price was advanced from 7.10 to 7.25c. per pound, despite the failure of London quotations to warrant such an advance. Apparently, the domestic situation is considered strong enough to permit the importation of some foreign bullion lead.

Until today, most of the Middle Western business was on the basis of 7c., St. Louis. Several higher prices were reported however, on both chemical and desilverized lead. Recently the Middle Western market has been particularly strong, and sellers of desilverized lead that normally do not enter this market have received offers that made such business attractive. Cable manufacturers have contributed greatly to the activity in lead.

Zinc Unchanged

Zinc continues to be sold at 6.35c., St. Louis, a good volume being marketed at that level this week, though the sales were not very evenly shared by producers. Galvanizers, brass mills, and manufacturers of assorted products were represented in the business, which

was mostly for forward shipment. Spot lots of High-Grade are quoted at 7¾c., delivered in the East.

Tin Continues Quiet

Conditions in tin are substantially unchanged. Prices were slightly lower today, seemingly because of the absence of the usual "bull" support in London.

Silver Quiet and Steady

Little change in the silver market occurred in the past week, prices fluctuating between 56¼ and 56½c. and closing today at 56⅜c. Reports from abroad state that the Indian bazaars were buyers there and moderate purchases have been made in this market for China account. The tendency is quiet and steady.

Mexican Dollars (Old Mexican pesos): Feb. 28th, 42⅝c.; March 1st and 2d, 42½c.; 4th, 42⅝c.; 5th, 42½c.; 6th, 42⅝c.

Foreign Exchange

Closing cable quotations on Tuesday, March 5, were as follows: Francs, 3.90⅛c.; lire, 5.23⅛c.; and marks, 23.72¼c. Canadian dollars, ⅜ per cent discount.

Lead Concentrate Now $97.50 in Joplin

	Per Ton
Blende	
High	$43.80
Premium blende, basis 60 per cent zinc	$41.00@ 42.00
Prime Western, basis 60 per cent zinc	40.00@ 41.00
Table concentrate, basis 60 per cent zinc	37.00@ 39.00
Flotation concentrate, 60 per cent zinc	36.00@ 38.00
Average settling price, all blende	42.51
Galena	
High	$98.00
Basis 80 per cent lead	97.50
Average settling price, all lead	95.51

Shipments for the week: Blende, 14,554; lead, 1,923 tons. Value; all ores the week, $795,690.

Open market quotations of $97.50 for lead concentrate were made today, following two weeks of private contracts at this figure, during which $97.50 was paid in settlement for more than 3,000 tons.

Zinc ore prices remain unchanged, except that a division is made between table and flotation concentrates in response to the suggestion of some buyers and sellers who make settlements on *E.&M.J.* quotations.

Platteville, Wis., Feb. 23, 1929

Zinc Blende	Per Ton
Blende, basis 60 per cent	$43.25
Lead Ore	
Lead, basis 80 per cent	$95.00

Shipments for the week: Blende, 884 tons; lead, none. Shipments for the year: Blende, 5,109 tons; lead, 240 tons. Shipments for the week to separating plants, 1,611 tons blende.

Platteville, Wis., March 2, 1929

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$43.25
Lead Ore	
Lead, basis 80 per cent	$97.50

Shipments for the week: Blende, 681 tons: lead, 80 tons. Shipments for the year: Blende, 5,790: lead, 320 tons. Shipment for the week to separating plants, 1,028 tons blende.

Steel Production Continues to Increase; Prices Higher

Pittsburgh, March 5, 1929

Steel production increased slightly in February, to a record high rate for the month, and close to the record high for any month. There was a decided increase during the month in trade appraisals of the tonnage prospects, illustrated by the Frick company last week ordering 650 Connellsville coke ovens into blast as well as by the Carnegie Steel Company and two independents making large purchases of heavy melting steel scrap last week, when for two months buying of scrap had been light.

Apparently an important influence upon trade appraisals was the observation of the heavy shipping requirements to date, when at the beginning of the year there were seemingly unfavorable influences of high money rates, a decrease since Oct. 1 in the volume of fabricated structural steel contracts, and 15 per cent lighter buying of steel rails for this season's replacements than for the previous year. Nevertheless steel production since Jan. 1 has been 5 per cent or more above that in the same period of any previous year.

Early in the year steel prices were thought to be at a more or less permanent level, but in the last month hot-rolled strips have been marked up $2 a ton, and bars, shapes, and plates $1, whereas in the last ten days blue annealed, black, and galvanized sheets have been marked up $2 a ton and semi-finished steel has been advanced $1. Also a new list of cold-rolled strip extras has been issued, dated Feb. 28, involving an average advance of several dollars per ton.

Pig Iron—The Valley market has remained very quiet, with prices steady at $18 to $18.25 for Bessemer and $17.50 for basic and foundry. The strength of scrap may stiffen pig iron, and there are chances of Lake Superior iron ore being advanced 25c. per ton for the coming season.

Connellsville Coke — Spot furnace coke has advanced fully 25c. in the last month, being strong at $3 to $3.10, with foundry coke unchanged at $3.75 to $4.25.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified. London prices are according to latest mail advices.

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c. London, 98 per cent, quoted at £95 per long ton, less 2 per cent for domestic consumption.

ANTIMONY—Per lb., duty paid: Chinese brands, for all positions, 9¼c. Cookson's "C" grade, spot, 14¾c. Chinese needle, lump, 8c. Standard powdered needle, 200 mesh, 10c. Nominal.

BISMUTH—Per lb., in ton lots, $1.70. Smaller lots $1.85 and up. London 7s. 6d.

CADMIUM—Per lb., 85@95c. Active. London, 4s.@4s. 1d. for Australian metal, early delivery. Moderate demand.

CHROMIUM — Per lb., 97 per cent grade, $1.50.

COBALT — Per lb., f.o.b. Canadian works: Shot, 96@98 per cent, $2.10@$3. Black oxide, 70 per cent, $2.10. London, 10s. for metal in small lots, 8s. for black oxide; 8s. 10d. for gray.

[1]GERMANIUM OXIDE—Per gram in 300- to 500-gram lots, $3.50.

IRIDIUM—Per oz., $260@$265 for 98 @99 per cent sponge and powder. London, £57@£60.

[1]LITHIUM—Per oz., 98@99 per cent grade in 1- to 5-lb. lots, $5.

MAGNESIUM—Per lb., in ton lots, single orders for spot metal: 8-lb. ingots (3x3x15 or 16 in.), 85c.@$1.05, depending on quantity; 2½- or 3-lb. sticks (1⅜ in.), $0.90@$1.10, depending on quantity; 10-oz. sticks (1x12 in.), 85@90c. Discounts up to 20 per cent on larger orders or contracts. Market firm. London 3s. 3d.@3s. 6d. for 99 per cent ingots or sticks.

[1]MOLYBDENUM—Per lb. in 1- to 3-lb. lots, 99 per cent, $18. (Usually sold as calcium molybdate or ferromolybdenum, which see).

NICKEL—Per lb., ingot 35c.; shot 36c.; electrolytic, 35c. (99.90 per cent), for single lots of spot metal. London, per long ton, £170@£175 according to quantity.

OSMIUM—Per oz., $55@$65; London, £12@£14.

PALLADIUM — Per oz., $38@$40. London, £9 10s.@£10 10s.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $70. Transactions between dealers and refiners in the outside market are commonly reported at several dollars less.

London, per oz., £13 10s.@£13 17½s., for refined; crude and scrap, nominal at £13@£13½. Market slow.

QUICKSILVER—Per 76-lb. flask, $121 @$122. Small lots command the usual premium. Market very quiet. San Francisco wires $121.33 for retail and small wholesale lots. London quiet, with offers of spot at £22 2½s.@£22 5s.

RADIUM—Per mg. radium content, $70.

RHODIUM—Per oz., $40@$55. Nominal. London, £11@£12.

RUTHENIUM — Per oz., $45@$55. Nominal. London, £9@£10.

[1]SELENIUM — Per lb. in ton lots: Black, powdered, amorphous, 99.5 per cent pure, $2.25. London, 7s. 8d.@7s. 9d.

TANTALUM — Per gram: Bar and heavy sheet, chemically pure, 20c.; tantalum powder, 11c.

TELLURIUM—Per oz., 15@18c.

THALLIUM METAL—$12.50@$15 per pound.

TITANIUM—Per lb., 80@90 per cent grade, $5.

[1]Price furnished by Foote Mineral Co., Philadelphia.

TUNGSTEN POWDER—Containing 97 to 98 per cent tungsten, per lb., $1.20@$1.35, depending on quantity. Nominal.

VANADIUM—Per gram, 92@95 per cent grade, $1.25.

[1]ZIRCONIUM METAL—Per oz., 98 per cent grade, $1.56 in 5- to 10-lb. lots.

Metallic Ores

ANTIMONY ORE—Bolivian ore, 60 per cent metallic antimony, $1.30 per short ton unit, c.i.f. New York.

CHROME ORE—Per long ton, f.o.b. Eastern shipping points, Indian and Rhodesian ores, $22 for 47 per cent Cr_2O_3 ore to $23.50 for 50@51 per cent ore. New Caledonian ore, high-grade, $25.

IRON ORE—Per long ton, lower Lake ports. Lake Superior ores.

Mesabi, non-bessemer, 51½ per cent iron, $4.25. Old Range, non-bessemer, $4.25.

Mesabi, bessemer, 51½ per cent iron, $4.40. Old Range, bessemer, 51½ per cent, $4.55.

Eastern ores, cents per unit, delivered at furnaces: Foundry and basic, 56 to 63 per cent, 8c.

Foreign ores, f.o.b. cars Atlantic ports, cents per unit:

North African, low-phosphorus, 10 @11c.

Spanish and North African basic, 50@60 per cent, 8½@9c. Nominal.

Swedish foundry or basic, 66@68 per cent, 9@9½c.

Newfoundland foundry, 55 per cent, 8½c.

MANGANESE ORE—Per long-ton unit of Mn, c.i.f. North Atlantic ports. Exclusive of duty. Brazilian and Indian ores, minimum 47 per cent Mn, 34@35c. Caucasian (washed), 53@55 per cent, 37@39c. Market easy.

Per ton in carload lots:

[1]Chemical grades, powdered, coarse or fine, 82@87 per cent MnO_2. Brazilian and Cuban, $70@$80. Caucasian, minimum 85 per cent, $70. Montana, 70 to 75 per cent, $70@$80. Domestic, 70 to 72 per cent, $40@$50.

TANTALUM ORE—Per unit of Ta_2O_5, basis 60 per cent ore, $13.

TITANIUM ORE—Ilmenite, per gross ton, 52 to 60 per cent TiO_2, f.o.b. Atlantic seaboard, $9.50@$11, according to grade and impurities. Low-grade domestic, 32 to 35 per cent, about $7@$8 per gross ton. Rutile, per lb., 93 per cent concentrate, 10c. for 30-ton lots.

TUNGSTEN ORE—Per short-ton unit of WO_3, N. Y.: Wolframite, $11.65@$11.95. Western scheelite, $12@$12.50. Market firm and stocks very low.

VANADIUM ORE—Per lb. V_2O_5 contained, 28c.

ZIRCON ORE—Per net ton containing 55 per cent ZrO_2, f.o.b. Atlantic seaboard, $40@$45 in 30-ton lots.

Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can serve only as a general guide to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can be ascertained only by direct negotiation between buyer and seller.

[1]AMBLYGONITE—Per ton, f.o.b. mines: 8@9 per cent lithium oxide, $50@$60.

ASBESTOS — Per ton: f.o.b. Quebec mines, tax and bags included, prices quoted by leading interest for delivery on 1929 contract:

Crude No. 1, $550@$750; crude No. 2, $450@$575; spinning fibers, $225@$275; magnesia and compressed sheet fibers, $175@$225; shingle stock, $55@$115, various grades; paper stock, $45@$50; cement stock, $25; short fibers, $10@$20; floats, $12@$15.

Per ton c.i.f. New York: Rhodesian crude No. 1, $450; No. 2, $350.

BARYTES—Per ton: f.o.b. mines, bags extra:

Georgia: Barytes ore, crude (per long ton), $6.50. Washed and water floated to 97 per cent through 300 mesh, $19.

Missouri: Water ground and floated, bleached, $23; $25 in less than car lots, f.o.b. works. Crude ore, 93 per cent $BaSO_4$, not to exceed 1 per cent iron, $7.25 f.o.b. mines. Market good.

BAUXITE—Per long ton: Domestic ore, chemical, crushed and dried, 55 to 58 per cent Al_2O_3, 1.5 to 2.5 per cent Fe_2O_3, $7.50@$8.25 f.o.b. *Alabama* and *Arkansas* mines. Other grades, 56 to 59 per cent Al_2O_3, 5 to 8 per cent SiO_2, $6.75@$8.25 f.o.b. *Arkansas* mines. Pulverized and dried, $12@$14 f.o.b. *Arkansas* mines; calcined, 78 to 84 per cent Al_2O_3, $18@$20 f.o.b. *Arkansas* mines.

Per metric ton, foreign c.i.f. Atlantic port: Dalmatian, 50 to 55 per cent Al_2O_3, 1 to 3 per cent SiO_2, $4.50@$6.50; Istrian, 54 to 57 per cent Al_2O_3, 3 to 5 per cent SiO_2, $5.50@$7; French, 56 to 59 per cent Al_2O_3, 2 to 5 per cent SiO_2, $6@$8.

BORAX—Per lb.: Carload lots, in bags, crystals, 2¼c.; granulated or powdered, 2½c.; f.o.b. consumers' shipping point.

[1]CELESTITE—Per ton in carload lots: 90 per cent $SrSO_4$, finely powdered, $27.

CHALK—Per ton: Crude in bulk, c.i.f. *New York,* $4.75@$5.

CHINA CLAY (KAOLIN)—Per ton: F.o.b. *Virginia* mines, crude lump, No. 1, $7; crude No. 2, $5.50; washed, $8; powdered and air-floated, $8@$15; ground, $7@$10.

Florida, pressed pottery, bulk, $13; ground, No. 1, $20; No. 2, $15. Sprayed mineral flour in 100-lb. bags (bags extra), No. 1, $20; No. 2, $17.

Best grade, domestic, $16@$18, f.o.b. *Delaware* plants in carload lots. Market slow.

Imported English, f.o.b. American ports: Lump, $13@$21; powdered, $40@$45.

DIATOMITE—Per short ton, f.o.b. producing plant:

Kiln-fired brick, $65; kiln-fired aggregate, ¼ in., $45; insulating powder, $25; natural aggregate, ¼ in., $18@$20; air-floated powder, $45; 80 to 85 per cent silica, 98 per cent through 200 mesh, $20 in carload lots.

EMERY—F.o.b. *Pennsylvania* and *New York* in 350-lb. kegs, per lb.: Greek Naxos, 6½c.; Turkish, 6½c.; Khasia, 6½c.; domestic, 3½c. Market good.

FELDSPAR—F.o.b. mine or grinding plant:

North Carolina, per long ton, No. 1 pottery grade, crude, $6.50@$7.50; glass grades, $5@$6. Market fair.

No. 1, pottery, 140 mesh, $16; 200 mesh, $18. No. 2, enamel, 20 mesh, $10.25; 90 mesh, $12; 140 mesh, $13.75; 200 mesh, $15.50. No. 3, 20 mesh, $9.

New Hampshire, per ton: Pottery grade, $8. Best quality lump, $9.

New York, per ton: f.o.b. cars, No. 1 crude, $9.

Maine, per ton: Best pottery grade, ground, $19. Market slow.

FLUORSPAR — Per ton: F.o.b. *Kentucky* and *Illinois* mines:

Gravel, not less than 85 per cent CaF_2 and not over 5 per cent SiO_2, $18. Foundry lump, 85-5, $20. Ground, 95 to 98 per cent CaF_2, and not over 2½ per cent SiO_2, $32.50 in bulk; $36.50 in bags or barrels. Acid lump, 98-1, $30 in car lots. Market very firm.

New Mexico: 85-5 gravel, $16.50; 85-5 lump, $16.50; 94-3 lump, $21; 96-3 100-mesh, $30.

Foreign spar, duty paid, $19.40, tidewater.

FULLER'S EARTH — Per ton, f.o.b. *Florida:* 16 to 30 mesh, $16.50; 30 to 60 mesh, $18; 16 to 60 mesh, $17; 60 to 90 mesh, $14; 100 mesh up, $7. Market fair.

Powdered, import duty paid, $24@$25 per ton.

GARNET—Per ton; domestic, f.o.b. mines, $85.

Spanish grades, $60, c.i.f. port of entry.

GILSONITE — Per ton, carload lots, f.o.b. mines *Colorado.*

Selected grade, $33; seconds (mine run), $25.50.

GRAPHITE—Per lb., f.o.b. *New York:* Ceylon lump, 8½@8¾c.; chip, 7@7½c.; dust, 3@5½c.; Madagascar flake, 6½@7½c. Market firmer.

No. 1 flake, 8c. and up. No. 2 flake, 6c. and up. Foundry facings, 3c. and up. Graphite facings, 4c. and up. Amorphous and crystalline, fine ground, 3c. and up. Market steady but highly competitive. Prices for imported material slightly lower than last year.

Crude amorphous graphite, $15@$35 per ton, according to grade. Demand slightly improved.

GREENSAND—Per ton, f.o.b. cars, *New Jersey:* Screened and bagged, best grade in carload lots, $20. Market quiet.

GYPSUM—Per ton, f.o.b. mill, depending upon location: Crushed, $1.70@$6; ground, $4@$9; agricultural, $4@$9; calcined, $4@$13.

IRON OXIDE (See Ocher)—Per lb.: Standard Spanish red, 3@4½c.; domestic earth, 2@4½c.

KAOLIN—See China Clay.

[1]LEPIDOLITE—Per ton: $20@$30 for ordinary grades. Nominal.

LIMESTONE—Per ton: f.o.b. shipping points, depending on location, either lump or crushed, 25c.@$3.

Agricultural, 40c. up to $5 for crushed or pulverized. Prices depend upon source, purity, and fineness.

MAGNESITE — Per short ton, f.o.b. *California* mines: Grade "A" calcined, 80 per cent through 200 mesh, $43; Grade B, $40; dead burned, $29; crude, $11. *Washington:* Dead-burned magnesite, $22@$24 per net ton, Chewelah, Wash.

MICA—Per ton, f.o.b. plant:

New Hampshire: Mine run, $250; clean shop scrap, $25; roofing, $23. White dry ground, 20 mesh, $28; 40 mesh, $38; 60 mesh, white, $60; off-color, $34; 100 mesh, $70; 200 mesh, $80. Granite mica facings for cement block and stucco use, $8@$12, depending on size between ¼ in. and 60 mesh. Market fair.

North Carolina: White, ground, 20 mesh, $35; 70 mesh, $100.

Madagascar, amber, per lb., f.o.b. *New York,* duty paid: No. A1, $2.50; No. 1, $2; No. 2, $1.65; No. 3, $1.15; No. 4, 60c.; No. 5, 45c.

[1]MONAZITE—Per ton: (Minimum 6 per cent ThO_2), $130.

OCHER — F.o.b. *Georgia* mines, per ton: $19@$20 in sacks; $21@$22 in barrels; washed and water floated, $18; second grade, 99 per cent through 225 mesh, $18.

PHOSPHATE—Per long ton, f.a.s. or f.o.b. mines:

Florida, pebble, f.a.s., for export: 76@77 per cent, $7; 75 per cent, $6.25; 74@75 per cent, $6; 70 per cent, $4.50; 68 per cent, $4.10. Prices firm.

Florida, pebble, domestic: 76@77 per cent, $6.50; 74@75 per cent, $5.50; 72 per cent, $4.50; 70 per cent, $4.

Tennessee, ground, 90 per cent through 200 mesh, 33 per cent P_2O_5, $11.20 per short ton. Brown lump for acid manufacture, per gross ton, $6 on 75 per cent basis; $5.25 on 72 per cent basis. Non-acidulated, fine ground, 65 per cent, $8 (per short ton). Prices firm.

POTASH—The ruling contract prices are as follows:

	Bags	Bulk
Muriate of potash 80 @ 85 per cent, basis 80 per cent.....	36.40	34.80
Sulphate of potash 90 @ 95 per cent, basis 90 per cent..	47.30	45.70
Sulphate of potash-magnesia 48 @ 53 per cent, basis 48 per cent	27.25	25.65
Manure salt 30 per cent.....	21.75	18.75
Manure salt 20 per cent.....	15.40	12.40
Kainit 14 @ 16 per cent.....	12.50	9.50
Kainit, 12.4 per cent.....	12.00	9.00

Two thousand pounds net weight, c.i.f. Atlantic and Gulf ports. German weights, tares and analyses.

PUMICE STONE—Per lb.: In barrels, powdered, 2½@4c.; selected lump, 5@7c.

PYRITES—Per long ton unit of sulphur: C.i.f. United States ports; guaranteed 48 per cent sulphur: Spanish, 13c.; Tharsis, furnace size, 2½ in. diameter, 14c. Cinder from ore to remain property of buyers.

[1]QUARTZ ROCK CRYSTALS—Per lb. in ton lots: Colorless, clear but flawed, pieces ¼ to ½ lb. in weight, 20c. For optical purposes, four times above price; larger crystals still higher.

SILICA—Per ton: Water ground and floated, in bags, f.o.b. Illinois: 400 mesh, $31; 350 mesh, $26; 250 mesh, $18. Market fair. Glass sand, f.o.b. producing plant, 75c.@$5 per ton; molding sand, 65c.@$3.50; blast sand, $1.35@$3.50. Market fair.

[1]SPODUMENE — Per ton: $20@$30, depending upon lithium content. Nominal.

SULPHUR—Per long ton for domestic market, $18 f.o.b. Texas mines; $22 for export, Atlantic ports. Prices in reality are on a c.i.f. basis, but the average price reduced to an f.a.s. figure is about as given. Open prices $1 to $3 higher than above.

TALC—Per ton, carload lots, f.o.b. works, containers included:

Vermont: 99 per cent through 200 mesh, extra white, $9@$9.50; 97½ to 98½ per cent through 200 mesh, medium white, $8.50@$9; packed in 50-lb. paper bags; prices $1 per ton less in burlap sacks plus 15c. net for bags packed 12 to the ton.

New York: Double air-floated, short fiber, 200 mesh, $13.75; 325 mesh, $14.75.

Georgia: Powdered, gray, $7.50@$10; yellow, $9@$12; red, $11@$13; roofing, $7.50@$9.

New Jersey: Soapstone, ground, $10@$12.

TRIPOLI—Per short ton, burlap bags, paper liners, minimum carload 30 tons, f.o.b. *Missouri:* Once ground through 40 mesh; rose and cream colored, $14. Double ground through 110 mesh; rose and cream, $17. Air-floated through 200 mesh, rose and cream, $25; mill run, $15.

Metallic Compounds

ANTIMONY OXIDE—White, Chinese, 99 per cent Sb_2O_3, 14½c. per lb. Nominal.

ARSENIOUS OXIDE (White arsenic)—Per lb., 4c.; delivered near by. Market firm. London, per long ton, £16@£16½ quoted for Cornish white; Mexican high grade, £17 5s., c.i.f. Liverpool.

CALCIUM MOLYBDATE OR MOLYTE — Per lb. of contained Mo, 95c., delivered.

COPPER SULPHATE (Blue Vitriol)—Per lb. in car lots, 6.20c., for either large or small crystals.

SODIUM NITRATE—Per 100 lb.: crude, in bags ex vessel, Atlantic ports, $2.22½ for all positions.

SODIUM SULPHATE (Salt Cake)—Per ton, bags, f.o.b. works, $20; in barrels, $24@$33.

ZINC OXIDE—Per lb. in bags, in car lots: Lead-free, 6½c.; 10, 20 or 35 per cent leaded grades, 6⅝c.; French red seal, in bags, 9⅜c.

Alloys

[1]FERROCERIUM—Per lb., $7 in 15 to 75 lb. lots.

[1]Price furnished by Foote Mineral Co., Philadelphia.

FERROCHROME—Per lb. of contained chromium, 60@70 per cent chromium, 4 to 6 per cent carbon, 11c. Freight allowed in carload lots east of Mississippi River and north of Baltimore.

FERROMANGANESE — Per gross ton furnace: Domestic and foreign, 78@82 per cent, $105. Spiegeleisen, 19@21 per cent, $33@$34 on carload business, f.o.b. furnace.

FERROMOLYBDENUM—Per lb. of Mo, f.o.b. shipping point, 50@60 per cent Mo, $1.20.

FERROPHOSPHORUS—Per ton, 18 per cent P, $91; electrolytic, 24 per cent, $122.50; f.o.b. *Alabama* and *Tennessee.*

FERROSILICON—Per gross ton, f.o.b. works, freight allowed on carload lots east of Mississippi River and north of Baltimore: 50 per cent, $83.50; 75 per cent, $130; 15@17 per cent, $45, f.o.b. Suspension Bridge, N. Y. Quotations for spot shipments $5@$10 per ton higher on 50 and 75 per cent grades. Market active.

FERROCARBONTITANIUM — Per ton: $160, f.o.b. producer's plant.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent W, $1.04@$1.10, f.o.b. works.

FERROVANADIUM—Per lb. of V contained, f.o.b. works, freight allowed, $3.15@$3.50, depending on grade and quantity.

NICKEL SILVER—Per lb. for 18 per cent nickel Grade A sheets: Price advanced from 33⅞c. to 34½c. on March 4.

YELLOW (MUNTZ) METAL—Dimension sheets, per lb.: Price advanced from 24⅜c. to 24⅞c. on March 4; rods, per lb., price advanced from 21⅜c. to 21⅞c. March 4.

Rolled Metals

COPPER—Sheets, hot-rolled, per lb., price advanced from 28⅜c. to 29⅛c. on March 4; wire, per lb., f.o.b. mill, price advanced from 21⅛c. to 21⅜c. March 2.

LEAD SHEETS—Full rolled, 10¾c. per lb.; clipped, 11c.

MONEL METAL—Per lb., sheets, full finished, 42c.; rods, hot-rolled, 35c.

NICKEL—Per lb., sheets, full finished, 52c.; rods, hot-rolled, 45c.

ZINC SHEETS — Per lb., 9¼c., f.o.b. works.

Refractories

CHROME BRICK—Per net ton, f.o.b. shipping point, $45.

FIRECLAY BRICK — Per M.: First quality, $43@$46, *Ohio, Kentucky, Central Pennsylvania;* second quality, $35@$38.

MAGNESITE—Brick, per net ton, f.o.b. works: 9-in. straights, $65. Cement, $40, seaboard.

SILICA BRICK—Per M., *Pennsylvania* and *Ohio,* $43; *Alabama,* $51; *Illinois,* $52.

ZIRKITE—Per lb.; Powdered, 65@70 per cent ZrO_2, 3½c. Brick, straights, 80c.@$1 each.

Metal Statistics

Monthly Average Prices of Metals

Silver

	New York		London Spot		Sterling Exchange	
	1928	1929	1928	1929	1928	1929
January	57.135	57.819	26.313	26.257	487.098	484.577
February	57.816	56.210	26.205	25.904	487.008	484.787
March	57.245	.....	26.329	.....	487.558	.....
April	57.395	.....	26.409	.....	487.785	.....
May	60.298	.....	27.654	.....	487.685	.....
June	60.019	.....	27.459	.....	487.565	.....
July	59.215	.....	27.262	.....	485.923	.....
August	58.880	.....	27.096	.....	484.979	.....
September	57.536	.....	26.440	.....	484.654	.....
October	58.087	.....	26.727	.....	484.584	.....
November	57.953	.....	26.704	.....	484.492	.....
December	57.335	.....	26.349	.....	484.698	.....
Year	58.176	.....	26.746	.....	486.169	.....

New York quotations, cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic		London Spot Standard		London Spot Electrolytic	
	1928	1929	1928	1929	1928	1929
January	13.854	16.603	61.912	75.551	66.575	78.602
February	13.823	17.727	61.670	78.228	66.381	83.538
March	13.845	.....	61.148	.....	66.443	.....
April	13.986	.....	61.678	.....	66.500	.....
May	14.203	.....	62.554	.....	67.216	.....
June	14.527	.....	63.664	.....	68.738	.....
July	14.527	.....	62.881	.....	68.670	.....
August	14.526	.....	62.472	.....	68.750	.....
September	14.724	.....	63.522	.....	69.800	.....
October	15.202	.....	65.524	.....	71.935	.....
November	15.778	.....	68.080	.....	74.750	.....
December	15.844	.....	69.336	.....	75.000	.....
Year	14.570	.....	63.703	.....	69.230	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London			
	1928	1929	1928	1929	1928 Spot	1928 3 Mos.	1929 Spot	1929 3 Mos.
January	6.500	6.650	6.280	6.498	21.773	22.213	22.111	22.344
February	6.329	6.853	6.069	6.739	20.283	20.747	23.128	23.156
March	6.000	.....	5.805	.....	19.938	20.352	.....	.....
April	6.100	.....	5.991	.....	20.306	20.563	.....	.....
May	6.123	.....	6.012	.....	20.483	20.813	.....	.....
June	6.300	.....	6.152	.....	20.985	21.211	.....	.....
July	6.220	.....	6.038	.....	20.602	20.957	.....	.....
August	6.248	.....	6.056	.....	21.634	21.628	.....	.....
September	6.450	.....	6.286	.....	22.050	21.769	.....	.....
October	6.500	.....	6.318	.....	22.082	21.796	.....	.....
November	6.389	.....	6.222	.....	21.239	21.469	.....	.....
December	6.495	.....	6.343	.....	21.342	21.730	.....	.....
Year	6.305	.....	6.131	.....	21.060	21.271	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Tin

	New York		London	
	1928	1929	1928	1929
	Straits		Spot	
January	55.650	49.139	253.222	222.727
February	52.440	49.347	233.833	223.138
March	52.220	.....	232.722	.....
April	52.270	.....	234.204	.....
May	51.582	.....	230.886	.....
June	47.938	.....	217.280	.....
July	47.040	.....	212.449	.....
August	48.012	.....	212.847	.....
September	48.073	.....	215.663	.....
October	48.966	.....	222.005	.....
November	50.750	.....	232.875	.....
December	50.185	.....	227.586	.....
Year	50.427	.....	227.131	.....

New York quotations, cents per pound. Quotations on 99 per cent tin discontinued on April 1, because of absence of business. London, pounds sterling per long ton.

Zinc

	St. Louis		London			
	1928	1929	1928 Spot	1928 3 Mos.	1929 Spot	1929 3 Mos.
January	5.643	6.350	26.125	26.051	26.196	26.233
February	5.551	6.350	25.518	25.506	26.247	26.347
March	5.624	.....	25.082	24.960	.....	.....
April	5.759	.....	25.493	25.316	.....	.....
May	6.026	.....	26.102	25.756	.....	.....
June	6.158	.....	25.664	25.429	.....	.....
July	6.201	.....	24.946	24.972	.....	.....
August	6.249	.....	24.540	24.713	.....	.....
September	6.250	.....	24.497	24.625	.....	.....
October	6.250	.....	24.030	24.296	.....	.....
November	6.263	.....	24.801	24.827	.....	.....
December	6.349	.....	26.609	26.615	.....	.....
Year	6.027	.....	25.284	25.256	.....	.....

St. Louis quotations, cents per pound. London pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) Refined New York		Platinum (c) Crude New York	
	1928	1929	1928	1929	1928	1929	1928	1929
Jan.	10.863	9.558	123.620	119.481	79.280	70.000	69.280	60.000
Feb.	10.842	9.548	121.370	119.818	84.783	70.000	74.783	60.000
March	10.083	.....	122.557	.....	80.000	.....	70.000	.....
April	9.865	.....	123.740	.....	80.000	.....	70.000	.....
May	11.019	.....	123.173	.....	78.000	.....	68.000	.....
June	9.750	.....	122.423	.....	78.000	.....	68.000	.....
July	9.540	.....	121.260	.....	78.000	.....	68.000	.....
Aug.	10.181	.....	124.500	.....	78.000	.....	68.000	.....
Sept.	10.813	.....	128.000	.....	78.000	.....	68.000	.....
Oct.	10.841	.....	125.923	.....	78.000	.....	68.000	.....
Nov.	10.109	.....	123.000	.....	76.417	.....	66.418	.....
Dec.	9.748	.....	122.500	.....	74.480	.....	64.480	.....
Year	10.305	.....	123.506	.....	78.580	.....	68.580	.....

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quicksilver in dollars per flask of 76 lb. Prior to June, 1927, the unit had been the 75-lb. flask. (c) Platinum in dollars per ounce.

Pig Iron, Valley[1], and Aluminum

	Bessemer		Basic		No. 2 Foundry		Aluminum	
	1928	1929	1928	1929	1928	1929	1928	1929
Jan.	17.50	18.00	17.00	17.50	17.25	17.50	24.300	24.300
Feb.	17.50	18.00	17.00	17.50	17.25	17.50	24.300	24.300
March	17.50	.....	17.00	.....	17.25	.....	24.300	.....
April	17.50	.....	17.00	.....	17.25	.....	24.300	.....
May	17.37	.....	16.38	.....	17.24	.....	24.300	.....
June	17.00	.....	15.56	.....	16.79	.....	24.300	.....
July	17.00	.....	15.75	.....	16.69	.....	24.300	.....
Aug.	17.00	.....	15.75	.....	16.50	.....	24.300	.....
Sept.	17.00	.....	15.75	.....	16.50	.....	24.300	.....
Oct.	17.24	.....	16.66	.....	16.74	.....	24.300	.....
Nov.	17.82	.....	17.32	.....	17.32	.....	24.300	.....
Dec.	18.00	.....	17.50	.....	17.50	.....	24.300	.....
Year	17.37	.....	16.56	.....	17.02	.....	24.300	.....

Iron in dollars per long ton. Aluminum in cents per pound, 99 per cent grade.
[1]F.o.b. Mahoning and Shenango valley furnaces; freight to Pittsburgh, $1.76.

Monthly Crude Copper Output in Short Tons

	1928 Aug.	Sept.	Oct.	Nov.	Dec.	1929 Jan.
Domestic						
Alaska shipments	2,219	661	3,036	1,313	1,807	2,145
Calumet & Arizona	2,205	2,537	2,201	3,006	2,890	2,150
Magma	1,427	1,678	1,877	1,635	1,436	1,730
Miami	1,924	1,770	2,133	2,119	2,148	2,262
New Cornelia	3,673	3,230	3,190	3,340	4,143	3,104
Nevada Con.	.....	†35,476	.....	.....	†40,613	.....
Old Dominion*	968	818	840	943	804	921
Phelps Dodge††	9,330	7,892	10,054	9,080	10,361	9,850
United Verde Extension	2,027	1,757	2,065	2,133	2,344	2,338
Utah Copper	.....	†35,858	.....	.....	†42,956	.....
Tennessee Copper	594	594	621	639	558	597
Foreign						
Andes Copper	4,016	4,925	6,180	7,835	.....	.....
Braden	8,234	8,193	9,265	10,438	.....	.....
Boleo, Mexico	.....	†3,053	.....	.....	†3,422	.....
Bwana M'Kubwa	499	556	530	533	649	812
Chile	9,365	11,336	14,368	.....	.....	.....
Furukawa, Japan	1,536	1,661	1,547	1,396	1,468	.....
Granby Cons., Canada	2,517	2,445	2,447	2,359	2,465	2,677
Howe Sound	.....	†5,039	.....	.....	†5,490	.....
Mount Lyell, Australia	.....	†2 274	.....	.....	†1,204	.....
Sumitomo Japan	1,643	1,677	1,466	1,562	1,660	.....
Union Miniere, Africa	10,775	10,248	10,120	10,174	9,440	.....

†Three months. *Includes Arizona Commerical.
††Moctezuma is included.

Monthly Production of Primary Copper from U. S. Mines and Daily Rate (Short Tons)

	1927 Monthly Production	1927 Daily Rate	1928 Monthly Production	1928 Daily Rate	1929 Monthly Production	1929 Daily Rate
January	76,198	2,458	68,469	2,209	86,681	2,796
February	69,202	2,472	67,423	2,352	.....	.....
March	69,314	2,236	70,327	2,269	.....	.....
April	71,122	2,371	69,721	2,324	.....	.....
May	71,613	2,310	73,729	2,378	.....	.....
June	69,539	2,318	73,224	2,441	.....	.....
July	65,545	2,114	73,426	2,369	.....	.....
August	67,248	2,169	76,952	2,482	.....	.....
September	65,936	2,198	78,341	2,611	.....	.....
October	68,545	2,225	86,480	2,790	.....	.....
November	68,080	2,269	85,382	2,846	.....	.....
December	67,377	2,173	85,673	2,764	.....	.....
Total	829,878	.....	909,147	.....	.....	.....
Monthly average	69,165	.....	75,762	.....	.....	.....
Average of daily rate	.....	2,274	.....	2,484	.....	.....

Mining Stocks—Week Ending March 2, 1929

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	155	135	151	Mr.29,My.20	Q 1.75
Andes Copper	New York	68⅛	58¼	66½	Mr.29, My.6	Q 0.75
Arizona Com	Boston	5	4	4⅛	Ja. 16, Ja. 31	S.A. 0.25
Calumet & Ariz	New York	142⅛	129⅛	139⅛	Mr.7, Mr.25	Q 1.50
Calumet & Hecla	Boston	61¼	56½	61¼	Fe. 28, Mr. 30	Q 1.00
Cerro de Pasco	New York	120	107⅛	116½	Ja. 11, Fe. 1	Q 1.25
Chile Copper	New York	112½	97⅛	110½	Mr.22, Ap.22	Q 0.87½
Con. Coppermines	N. Y. Curb	17	13⅛	16½		
Copper Range	Boston	33	27⅛	32⅛	De. 15, Ja. 15	0.50
East Butte	Boston	4⅛	3 11/16	4⅛	Dec., 1919	0.50
Granby Con	New York	95⅛	89	93⅛	Ja. 4, Fe. 1	Q 1.00
Greene Cananea	New York	190	173	183⅛	Mr. 7, Ap. 1	Q 2.00
Howe Sound	New York	81⅛	72⅛	78⅛	De. 31, Ja. 5	Q 1.00
Hudson Bay	N. Y. Curb	22⅛	21⅛	22⅛		
Inspiration	New York	66⅛	54⅛	64⅛	Mr.14, Ap. 1	Q 1.00
Isle Royale	Boston	34	27⅛	31⅛	Fe. 28, Mr.30	X 0.50
Kennecott	New York	158⅛	156⅛	156⅛	No. 30, Ja. 2	Q 2.00
Kennecott, new	N. Y. Curb	92⅛	78⅛	91⅛	Mr.1, Ap.1	Q 1.00
Magma Copper	New York	80⅛	73⅛	79	De. 31, Ja. 15	Q 1.00
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛		
Miami Copper	New York	47	39⅛	46	Fe.1, Fe.15	Q 0.50
Mohawk	Boston	46	43⅛	45⅛	Ja. 26, Mr. 1	Q 1.50
Mother Lode	New York	6	4⅛	5⅛	De.14, De.31	SA 0.20
Nevada Con	New York	60⅛	49⅛	58⅛	De.14, De.31	Q 0.50
New Cornelia	N. Y. Curb	48⅛	42⅛	46	Fe. 1, Fe. 18	Q 0.50
Noranda	N. Y. Curb	65⅛	60⅛	64⅛		
Ohio Copper	N. Y. Curb	4⅛	3⅛	4⅛	Sept., 1926	0.03
Old Dominion	Boston	19	16⅛	18	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	85	75	84⅛	Mr. 15, Ap. 1	Q 2.50
Quincy	Boston	51	43⅛	49	March, 1920	1.00
Roan Antelope	N. Y. Curb	48⅛	44⅛	48		
St. Mary's M. L.	Boston	43	37⅛	41	Fe.25, Mr.12	2.00
Seneca Copper	New York	7⅛	6	7⅛		
Shattuck Denn	N. Y. Curb	28	25	26⅛		
Sherritt-Gordon	Toronto			8.10		
Tenn. C. & C.	New York	20⅛	18⅛	19⅛	Fe.28, Mr.15	Q 0.25
United Verde Ex	N. Y. Curb	19⅛	15⅛	18⅛	Ja. 4, Fe. 1	Q 0.75
Utah Copper	New York	305	275	305	De. 14, De. 31	Q 3.00
Waite-Ack.-Mont	Toronto			2.35		
Walker Mining	Salt Lake	3.25	2.70	3.25		
Wenden Copper	N. Y. Curb	2	1⅞	2		
LEAD, ZINC, SILVER						
Ahumada Lead	New York	4⅛	4⅛	4⅛		
Amer. Z. L. & S	New York	44⅞	38⅛	42⅛	May, 1917	1.00
A. Z. L. & S., pfd	New York	105⅛	102⅛	102⅛	Nov., 1920	1.50
Bingham Mines	Boston	53	51⅛	51⅛	De. 20, Ja. 5	Q 0.50
Bunker Hill & S	N. Y. Curb	141	139	139⅞	Ja. 31, Fe. 5	X 0.75
Butte Cop. & Zn	New York	9⅛	7⅞	8⅛		
Butte Cop. Con	Boston Curb	*97	*90	*93		
Butte & Sup	New York	10⅛	9⅛	10⅛	Dec. 31,	Q 0.50
Callahan Zn-Ld	New York	3⅜	3⅛	3⅛	Dec., 1920	0.50
Chief Consol	Salt Lake	3.85	3.57½	3.75	Fe. 1, 1928	K 0.10
Consol. Ld. & Zn. "A"	St. Louis	12½	11⅛	11⅛	Ja. 1	K 0.25
Constitution	Spokane	*32	*28	*28		
Dayrock	Spokane	1.97	1.90	1.90		
Dickens Consol	Spokane	*26	*11	*17		
Eagle-Picher	Cincinnati	19⅛	19½	19⅛	Mr.31, Ap.15	Q 0.20
Eagle-Pich., pfd	Cincinnati			102	Jan. 15	Q 1.50
Erupcion	Boston Curb	*23	*20	*20	Ja. 1, 1928	Q 0.07½
Eureka Bullion	Salt Lake	*85	*78	*79		
Eureka Lily	Salt Lake			1.42½		
Eureka Standard	Salt Lake	4.50	4.50	4.50		
Evans-Wallower	N. Y. Curb	24⅛	22⅛	23⅛		
Evans-Wal., pfd	N. Y. Curb	89⅛	89⅛	89⅛	Jan. 15,	I 1.75
Federal M. & S	New York	301	301	301	Je., 1927	10.00
Fed. M. & S., pfd	New York			107⅛	Fe. 21, Mr. 15	Q 1.75
Gladstone	Spokane	*14⅛	*12⅛	*14⅛		
Golconda	Spokane	1.23	1.07	1.15	Mr.20, Ap.1	Q 0.02
Grandview	Spokane	*66	*60⅛	*63		
Hecla Mining	N. Y. Curb	17⅛	16⅛	17⅛	Fe.15, Mr.15	M 0.15
Highland-Surprise	Spokane	*18	*12⅛	*16		
Jack Waite	Spokane	*19⅛	*15	*15		
Kootenay Florence	Spokane	*21	19⅛	*20		
Lucky Jim	Spokane	*18	*17	*17		
Lucky Tiger-C	Kansas City	†5.40	†5.25		De.4, De.20	MX 0.12
Mexican Premier	Spokane	1.60	1.54	1.59		
National Lead	New York	153⅛	148	151⅛	Mr. 15, Mr. 31	Q 1.25
Natl. Lead, pfd. A	New York	140	140	140	Mr. 1, Mr. 15	Q 1.75
Natl. Lead, pfd. B	New York	122	122	122	Ap. 19, My 1	Q 1.50
N. J. Zinc	N. Y. Curb	311	306	311		
N. J. Zinc, new	N. Y. Curb	80⅛	80	80⅛		
New Quincy	Salt Lake	2.00	1.82½	1.92½		
Noble Five	Spokane	*67	*60	*62		
North Lily	Salt Lake	9.00	9.00	9.00	Jan. 20	Q 0.25
Park Bingham	Salt Lake	*12⅛	*8⅛	*11		
Park Utah	New York	13⅞	11⅛	13	De. 31, Ja. 2	Q 0.20
Pend Oreille	Spokane	13	11⅛	12		
Rico Argentine	Salt Lake	*42	*35	*42	No. 30, De. 15	Q 0.03
Ruth-Hope	Spokane	*50	*38	*45		
St. Joseph Lead	New York	81⅞	75½	79	Ju. 8, Ju.20	QX 0.75
Sherman Lead	Spokane	*26½	*22	*22		
Silver King Coa	Salt Lake	14.12½	13.62½	14.12½	De. 15, Ja. 2	Q 0.25
Silversmith	Spokane	*15	*14⅛	*14⅛	Oct., 1926	Q 0.02
Sunshine Mining	Spokane	1.46	1.43	1.43	De. 20, BM	0.02
Tamarack-Custer	Spokane	*47⅛	*40½	*42	Sept., 1924	0.25
Tintic Standard	Salt Lake	14.75	14.00	14.75	De. 23, Ja. 23	X 0.20
Tonopah Belmont	N. Y. Curb	1.00	*90	*90	Oct., 1925	0.05
Treadwell-Yukon	Toronto	18.50	12.90	15.25		
United Zinc Smg	N. Y. Curb	1⅛	1⅛	1⅛		
Utah Apex	Boston	5⅛	5	5⅛	Je. 14, Au. 1	K 0.25
Utah Met. & Tun	Boston	1⅛	1⅛	1⅛	Dec., 1917	0.30
Whitewater	Spokane	1.25	1.05	1.05		
Yellow Pine	Los Angeles	*10	*10	*10	Dec., 1925	QX 0.04
GOLD						
Alaska Juneau	New York	9⅛	7⅛	8⅛		
Barry-Hollinger	Toronto	*30	*28	*30		
Central Manitoba	Toronto	*62	*60	*61		
Coniaurum	Toronto	1.95	1.75	1.75		
Creason Consol	N. Y. Curb	*98	*93	*97	Jan. 15,	Q 0.02
Dome Mines	New York	10⅛	9⅛	10	De. 21, Ja. 21	Q 0.25
Golden Cycle	Col. Springs	†1.63	†1.62		Fe.15, Mr.1	0.04
Gold Hill	Toronto	*7⅛	*6	*6½		
Hollinger	Toronto	8.55	8.15	8.50	Mr.8, Mr.25	Q 0.05
Homestake	New York	73⅛	72⅛	73	Fe.20, Fe.25	MX 0.50
Kirland Lake	Toronto.	1.63	1.34	1.49		
Lake Shore	Toronto	27.50	21.45	26.00	Mr.1, Mr.15	Q 0.20
McIntyre-Porc	New York			20⅛	Fe.1, Mr.1	Q 0.25
Portland	Colo. Springs	†*10	†*9		April, 1927	0.02
Rand Mines	New York			36⅛	Fe. 21, '28	Am.Sh. 1.52
Siscoe	Toronto			1.35		
Sylvanite	Toronto	2.15	2.03	2.05		
Teck-Hughes	Toronto	10.30	8.95	10.00	Ja. 31, Fe. 1	Q 0.15
Tom Reed	Los Angeles	*35	*30	*30	Dec., 1926	0.02
Unity Gold	N. Y. Curb	1⅛	*80	1		
Vipond Consol	Toronto	1.20	1.12	1.15	April, 1927	0.03
Wright-Hargreaves	Toronto	2.55	2.00	2.30	Oc. 16, No. 1	0.02½
Yukon-Alaska	N. Y. Curb	35⅛	34⅛	35⅛		
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	19⅛	17⅛	19⅛		
Castle-Trethewey	Toronto	*39	*36	*38		
Cent. American	N. Y. Curb					
Consol. Cortez	N. Y. Curb	*23	*20	*20		
Dolores Esperanza	N. Y. Curb	1⅛	1⅛	1⅛	July, 1923	0.05
Keeley	Toronto	*50	*48	*50	Mr.15, 1928	0.04
Mining Corp	Toronto	5.30	5.00	5.30	De.14, De.31	SA 0.15
Montana-Idaho	Spokane	*8⅛	*7⅛	*7⅛		
N. Y. & Hond. Ros	N. Y. Curb			17	Ja.16, Ja.26	QX 0.50
Nipissing	N. Y. Curb	3⅛	3	3⅛	Mr.30, Ap.20	Q 0.07½
Premier Gold	N. Y. Curb	1 11/16	1⅛	1 13/16	De. 14, Ja. 4	Q 0.06
Tonopah Exten	N. Y. Curb	*14	*11	*14	April, 1925	0.05
Tonopah Mining	N. Y. Curb			3 3/16	Se. 29, Oc. 20	SA 0.07½
United Eastern	N. Y. Curb	1 1/16	1	1 1/16		
Yukon Gold	N. Y. Curb	*90	*90	*90	June, 1918	0.02
IRON AND STEEL						
Bethlehem Steel	New York	106⅛	96⅛	105	Fe. 15,	R 1.00
Beth. Steel, pfd, 7%	New York	122⅛	121⅛	122⅛	Mr.4, Ap.1	Q 1.75
Cleveland-Cliffs	Cleveland	140	128	135	Ja.15, Ja.25	QX 2.00
Colo. Fuel & Iron	New York	74⅛	69⅛	73		
Colorado F. & I., pfd	New York			134⅛	Fe.11, Fe.25	Q 2.00
Great Northern Iron	New York	35⅛	33⅛	34⅛	Dec.15,	K 2.00
Inland Steel	New York	93⅛	89	93⅛	Fe. 15, Mr. 1,	Q 0.87½
Republic I. & S	New York	99⅛	86⅛	99⅛	Fe. 13, Mr. 1,	Q 1.00
Republic I. & S., pfd	New York	115⅛	113⅛	115⅛	Mr.11, Ap. 1,	Q 1.75
Sloss-Sheffield S. & I	New York	118⅛	116⅛	118⅛	Mr. 11, Mr.20,	Q 1.50
Sloss-Sheff. S. & I., pfd.	New York			108	Mr.20, Ap.1,	Q 1.75
U. S. Steel	New York	193⅞	184⅛	188⅛	Fe. 28, Mr. 30,	Q 1.75
U. S. Steel, pfd	New York	144⅛	141⅛	143⅛	Fe 2, Fe. 27,	Q 1.75
Virginia I. C. & C	New York	25	25	25	Jan., 1924	1.50
Virginia I.C.& C., pfd.	New York	48	45	45	Jl.16, 1928	SA 2.50
MISCELLANEOUS						
Aluminum Co. of Am.	N. Y. Curb	175	168	174⅛		
Alum.Co.of Amer., pf.	N. Y. Curb	106⅛	106	106⅛	Mr.15, Ap.1,	Q 1.50
American Metal	New York	73⅛	70⅛	72⅛	Fe.9, Mr.1	Q 0.75
Amer. Metal, pfd., 6%	New York			118	Fe.9, Mr.1,	Q 1.50
Amer. Sm. & Ref	New York	124⅛	114	121⅛		
Amer. Sm. & Ref., pfd.	New York	136⅛	135⅛	135⅛	Fe. 1, Mr. 1	Q 1.75
Ang.-Ch. Nitrate	N. Y. Curb	43	41	42⅛		
Asbestos Corp	Montreal	18	16	16	Jan. 1926	1.50
Asbestos Corp., pfd	Montreal	51	49⅛	50	De. 31, Ja. 15	Q 1.75
Consol. M. & S	Montreal	510	500	505	De.31, Ja.15, SA	X 6.25
De Beers Consol	New York			22	Ja. 19, Ja.26,	0.48
Federated Metals	N. Y. Curb	37	34⅛	36⅛		
Freeport Texas	New York	49⅛	46	47⅛	Ja. 15, Fe. 1	Q 1.00
Int. Nickel Can., new	New York	67⅛	60⅛	66⅛		
Int. Nickel, pfd	New York	121	121	121	Ja. 18, Fe. 1	Q 1.75
Newmont	N. Y. Curb	229	195½	220	De. 28, Ja. 15	Q 1.00
Patiño M. & E	New York	47⅛	39⅛	47⅛	Aug. 1928	4s.
So. America G. & P	N. Y. Curb	3⅛	3	3⅛		
Texas Gulf Sulphur	New York	77⅛	74⅛	76⅛	Mr.4, Mr.15	Q 1.00
U. S. Sm. R. & M	New York	69⅛	65⅛	69	De. 31, Ja. 15	Q 0.87½
U. S. Sm. R. & M., pfd.	New York	56	54⅛	56	De. 31, Ja. 15	Q 0.87½
Vanadium Corp	New York	110⅛	106	108⅛	Fe.1, Fe. 15	Q 0.75

Toronto Standard Stock Exchange, Toronto, courtesy Arthur E. Moysey & Co.; Salt Lake Stock Exchange, courtesy J. A. Hogle & Co. and Logan & Bryan, New York; Spokane Stock Exchange, courtesy Pohlman Investment Company.

*Cents per share. †Bid or asked. Q, Quarterly. A. Annually. SA, Semi-annually. M, Monthly. BM, Bimonthly. FW, Four weeks. K, Irregular. I, Initial. R, Resumprion. X, Extra. The first data given is that of the closing of the books; the second that of the payment of the dividend.

LONDON QUOTATIONS—WEEK ENDED FEBRUARY 19, 1929

	High	Low	Last	Date	Amount
Alaska Mexican ($5)	12/—	12/—	12/—		
Alaska Treadwell (25)	41/6	40/7½	41/—	Nov., 1926	4 (d)
Armayo Mines (25 frs.)	67/6	63/9	66/3	Feb. 1929	5 (c)
Burma Corp (10 rupees)	17/10½	17/—	17/3	Feb., 1929	7 annas*
Bwana M'Kubwa (5s)	23/3	19/9	20/9		
Camp Bird (2s)	3/3	2/10½	3/—	April, 1928	16⅔
El Oro (£1)	5/6	4/10½	5/—	Nov., 1924	2½*
Frontino & Bolivia (£)	9/1½	8/7½	9/—	Jan., 1929	3⅔
International Nickel of Canada (no par value)	$67⅛	$59½	$62½		
Mexican Corpn. (£1)	12/3	9/—	11/9		
Mexican Mines of El Oro (£1)	12/6	7/6	10/—	Dec., 1926	3⅓*
Mount Isa (£)	43/1½	41/3	41/10½		
N'Changa Copper Mining. (£1)	81/3	70/—	78/9		
Oroville Dredging (4s)	2/9	2/9	2/9	Nov., 1928	31½
Rhodesian Congo Border (£1)	93/9	87/6	91/3		
St. John del Rey (£1)	12/3	11/9	12/—	Dec., 1928	2½
San Francisco Mines (10s)	35/9	34/9	35/3	Jan., 1929	25
Santa Gertrudis (£1)	11/6	10/7½	11/—	Jan, 1929	7½
Selukwe (2s. 6d.)	7/6	7/—	7/3	April, 1927	6⅔
S. Amer. Copper (2s.)	3/1½	2/10½	3/1½	Nov. 1917	75
Tanganyika (£1)	75/6	65/6	69/3	July, 1928	5
Union Miniere de Haut-Katanga (Brussels)	12,600	12,300	12,350	July, 1928	182.60‡

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation.

(Price quoted in dollars with a fixed rate of $5 to the £1)